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**Lean Implementation at White Sands Missile Range:
A Case Study of Lean Thinking Applied
In a Government Organization**

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December 2006

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13. ABSTRACT (maximum 200 words) <p>In this Joint Applied Project, we study application of lean thinking at White Sands Missile Range, an Army Major Range and Test Facility Base (MRTFB), tasked with developmental Test and Evaluation (T&E) as its primary mission. We interviewed a representative segment of leaders, managers, and working level lean implementers, and surveyed 285 participants in lean events at White Sands. We employed a comprehensive, uniform set of questions in those interviews and surveys to gain insight into significant expectations, questions, issues, concerns, difficulties, constraints, and uniquely governmental situations and circumstance related to this implementation. We organized and analyzed a massive and significant resulting data set around emerging themes including linkage between lean and personnel cuts, management support of lean, small incremental benefit versus large bottom-line impact, process documentation, metrics and measurement, vision, urgency, and goals, uniquely governmental issues, and the lean process itself.</p> <p>We offer relevant conclusions and recommendations, based on those themes, which may significantly aid similar government organization who are currently, or expectantly, engaged in lean implementations or other process improvement efforts. We offer those conclusions and recommendations as academic and neutral examinations of real issues associated with an actual lean implementation. Notwithstanding the difficulties and complexities that we have examined in this study, we find an overwhelming majority of our participants believe there was broad incremental benefit from lean, that its cost was warranted and necessary, and that it absolutely should continue to be used as a tool to achieve greater efficiency, quality, and effectiveness in government business processes.</p>				
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STUDY OF LEAN THINKING APPLIED IN A GOVERNMENT
ORGANIZATION**

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ABSTRACT

In this Joint Applied Project, we study application of lean thinking at White Sands Missile Range, an Army Major Range and Test Facility Base (MRTFB), tasked with developmental Test and Evaluation (T&E) as its primary mission. We interviewed a representative segment of leaders, managers, and working level lean implementers, and surveyed 285 participants in lean events at White Sands. We employed a comprehensive, uniform set of questions in those interviews and surveys to gain insight into significant expectations, questions, issues, concerns, difficulties, constraints, and uniquely governmental situations and circumstance related to this implementation. We organized and analyzed a massive and significant resulting data set around emerging themes including linkage between lean and personnel cuts, management support of lean, small incremental benefit versus large bottom-line impact, process documentation, metrics and measurement, vision, urgency and goals, uniquely governmental issues, and the lean process itself.

We offer relevant conclusions and recommendations, based on those themes, which may significantly aid similar government organization who are currently, or expectantly, engaged in lean implementations or other process improvement efforts. We offer those conclusions and recommendations as academic and neutral examinations of real issues associated with an actual lean implementation. Notwithstanding the difficulties and complexities that we have examined in this study, we find an overwhelming majority of our participants believe there was broad incremental benefit from lean, that its cost was warranted and necessary, and that it absolutely should continue to be used as a tool to achieve greater efficiency, quality, and effectiveness in government business processes.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
I. INTRODUCTION.....	3
A. PURPOSE.....	3
B. BACKGROUND	3
C. RESEARCH PROJECT OBJECTIVE	4
D. RESEARCH QUESTIONS.....	5
E. SCOPE AND LIMITATIONS.....	5
F. METHODOLOGY	6
1. Data Collection Methodology.....	6
2. Data Analysis Methodology	6
3. Conclusions and Recommendations Methodology	6
G. RESEARCH PROJECT REPORT ORGANIZATION.....	7
II. BACKGROUND	9
A. OVERVIEW OF WHITE SANDS MISSILE RANGE	9
B. WHAT IS LEAN?	12
C. RECOMMENDED PROCESSES FOR IMPLEMENTING LEAN.....	15
D. LEAN AND THE ARMY.....	18
E. CHRONOLOGY OF LEAN AT WHITE SANDS	21
III. DATA PRESENTATION.....	23
A. DATA SOURCES AND ORGANIZATION	23
B. DATA COLLECTION PROCESS.....	24
C. DATA	31
1. Linkage Between Lean and Personnel Cuts	31
2. Management Support of Lean	32
3. Small Incremental Benefits versus Large Bottom-line Impact.....	33
4. Process Documentation	34
5. Metrics and Measurement	35
6. Vision, Urgency, and Goals.....	35
7. Uniquely Governmental Issues	37
8. The Lean Process Itself.....	37
IV. DATA ANALYSIS.....	41
A. ANALYSIS APPROACH.....	41
B. ANALYSIS	41
1. Linkage between Lean and Personnel Cuts	41
2. Management Support of Lean	42
3. Small Incremental Benefits versus Large Bottom-line Impact.....	42
4. Process Documentation	43
5. Metrics and Measurement	44
6. Vision, Urgency, and Goals.....	44
7. Uniquely Governmental Issues	45
8. The Lean Process Itself.....	46

V.	CONCLUSIONS AND RECOMMENDATIONS	47
A.	SUMMARY	47
B.	CONCLUSIONS AND RECOMMENDATIONS.....	48
	1. Linkage between Lean and Personnel Cuts	48
	2. Management Support of Lean	48
	3. Small Incremental Benefits versus Large Bottom-line Impact.....	49
	4. Process Documentation	50
	5. Metrics and Measurement	51
	6. Vision, Urgency, and Goals.....	51
	7. Uniquely Governmental Issues	52
	8. The Lean Process Itself.....	55
C.	RECOMMENDATIONS FOR FURTHER STUDY	56
	1. Cost of Lean and Return on Investment.....	56
	2. Training Issues	57
	3. Lean Team Documents and Materials In-depth	57
	4. Significance to Current Army Lean Six-Sigma Effort	58
	5. Customer Focus Issues	58
	6. Time as a Primary Commodity of Value	58
	LIST OF REFERENCES.....	61
	APPENDIX A – ACRONYM LIST.....	63
	APPENDIX B - DATA.....	65
	INITIAL DISTRIBUTION LIST	95

LIST OF FIGURES

<i>Figure 1 – White Sands Land Area</i>	<i>11</i>
<i>Figure 2 - Organization.....</i>	<i>12</i>
<i>Figure 3 – Data Organization Model.....</i>	<i>23</i>
<i>Figure 4 – Survey Screen Shots.....</i>	<i>30</i>
<i>Figure 5 – Potential Lean Impact on WSMR Budget</i>	<i>53</i>
<i>Figure 6 – Survey Question 1</i>	<i>65</i>
<i>Figure 7 – Survey Question 2</i>	<i>66</i>
<i>Figure 8 – Survey Question 3</i>	<i>67</i>
<i>Figure 9 – Survey Question 4</i>	<i>68</i>
<i>Figure 10 – Survey Question 5.....</i>	<i>69</i>
<i>Figure 11 – Survey Question 6.....</i>	<i>71</i>
<i>Figure 12 – Survey Question 7.....</i>	<i>72</i>
<i>Figure 13 – Survey Question 8.....</i>	<i>74</i>
<i>Figure 14 – Survey Question 9.....</i>	<i>75</i>
<i>Figure 15 – Survey Question 10.....</i>	<i>77</i>
<i>Figure 16 – Survey Question 11.....</i>	<i>77</i>
<i>Figure 17 – Survey Question 12.....</i>	<i>79</i>
<i>Figure 18 – Survey Question 13.....</i>	<i>80</i>
<i>Figure 19 – Survey Question 14.....</i>	<i>81</i>
<i>Figure 20 – Survey Question 15.....</i>	<i>82</i>
<i>Figure 21 – Survey Question 16.....</i>	<i>83</i>
<i>Figure 22 – Survey Question 17.....</i>	<i>85</i>
<i>Figure 23 – Survey Question 18.....</i>	<i>86</i>
<i>Figure 24 – Survey Question 19.....</i>	<i>88</i>
<i>Figure 25 – Survey Question 20.....</i>	<i>89</i>
<i>Figure 26 – Survey Question 21.....</i>	<i>91</i>
<i>Figure 27 – Survey Question 22.....</i>	<i>92</i>
<i>Figure 28 – Survey Question 23.....</i>	<i>94</i>

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EXECUTIVE SUMMARY

Lean thinking is being employed in many companies representing a variety of industries, with significant results. The strength of lean thinking lies in its ability to identify and remove waste and needless activities. This streamlining typically allows the organization to eliminate waste and improve its processes, resulting in increased efficiency, lower cost, and most importantly higher quality for the customer. For many years lean was a manufacturer's tool. However, companies striving for overall improvement have found that lean is relevant in all areas of business ranging from research and development, to marketing and sales. Lean thinking now crosses the spectrum from companies involved in primarily manufacturing and assembly activities to businesses executing administrative processes with no manufacturing activities whatsoever.

This research project is focused on evaluating the implementation of lean thinking in a specific administrative environment - that of a Government agency. White Sands Missile Range is a Major Range and Test Facility Base facility whose mission is to conduct test and evaluation for Department of Defense weapon systems under development by the Army, Navy, and Air Force. White Sands executes many repetitive processes in the planning, conduct, and reporting of these tests. The processes are varied, wide-ranging, and administrative in nature. For specific reasons, which will be identified by the research, White Sands undertook a lean implementation to achieve certain efficiency improvements. This project will identify lessons learned during that process, and make recommendations for future lean implementations.

The results of this project will enable leaders, and those executing lean, to better understand the issues and obstacles they will likely face. This knowledge will facilitate the successful implementation of lean thinking in Government organizations resulting in increased efficiency, cost savings, and higher quality for Government customers.

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I. INTRODUCTION

A. PURPOSE

This research project is focused on evaluating the implementation of lean thinking in a specific administrative environment - that of a Government agency. White Sands Missile Range is a Major Range and Test Facility Base facility whose mission is to conduct test and evaluation for Department of Defense weapon systems under development by the Army, Navy, and Air Force. White Sands executes many repetitive processes in the planning, conduct, and reporting of these tests. White Sands undertook a lean implementation to achieve efficiency improvements in these processes. This project will examine that implementation in detail; identify lessons learned during the process; and make recommendations for future lean implementations.

The results of this project will provide valuable lean implementation insight to enable leaders, and those executing lean, to better understand the issues and obstacles they will likely face. This knowledge will facilitate the successful implementation of lean thinking in Government organizations resulting in increased efficiency, cost savings, and higher quality of service for Government customers.

B. BACKGROUND

Lean thinking is being employed in many companies representing a variety of industries, with significant results. The strength of lean thinking lies in its ability to identify and remove waste and needless activities. This streamlining typically allows the organization to eliminate waste and improve its processes, resulting in increased efficiency, lower cost, and most importantly higher quality for the customer. For many years lean was a manufacturer's tool. However, companies striving for overall improvement have found that lean is relevant in all areas of business ranging from research and development, to marketing and sales. Lean thinking now crosses the spectrum from companies involved in primarily manufacturing and assembly activities to

businesses executing administrative processes with no manufacturing activities whatsoever.

C. RESEARCH PROJECT OBJECTIVE

This research project examines and assesses the implementation of lean thinking at White Sands Missile Range. Processes used during White Sands' lean implementation are evaluated to identify issues, obstacles, and lessons learned. This report will serve as a documented case showing how "lean thinking" might be applied to a Government organization. Details of processes and techniques used in implementing "lean," obstacles that were encountered, benefits that accrued, and lessons learned that might have applicability for other Government activities that are considering whether to pursue lean in their organizations are presented. We had some definite ideas or suppositions in mind as we entered into, and planned this project. We present them here as a theoretical framework for the project which we propose to corroborate or refute through our research. Our hypotheses are:

- A large Government organization like White Sands Missile Range will act and react like any large bureaucratic institution with respect to lean implementation.
- There will likely be uniquely governmental conditions or circumstances that cause significant deviations from that expected organizational behavior.
- Detailed case study information and analysis of lean implementation in Government organizations is largely absent from relevant academic literature.
- There were, and are, significant misconceptions about lean among Government leaders, managers, and workers.
- Detailed analysis of the lean process is likely to produce valuable ancillary information, beyond the intended scope of the project.

D. RESEARCH QUESTIONS

The primary research question of this joint applied project is: How can a Government organization with primarily administrative processes overcome the significant issues and challenges associated with implementing LEAN thinking?

Secondary research questions are:

1. What is LEAN and LEAN thinking?
2. What are recommended processes for implementing LEAN?
3. How was implementation approached at White Sands?
4. What were the significant expectations, questions, issues, concerns, difficulties, and constraints related to this implementation?
5. Is there any uniquely governmental situation or circumstance that affected the implementation?
6. How might these issues be resolved/applied?
7. What are some possible strategies for successful LEAN implementation?
8. Was any ancillary information uncovered or identified during the research that may be of value in continuing or future lean implementations.

E. SCOPE AND LIMITATIONS

This research project examines the issues, obstacles, and lessons learned during a lean implementation at White Sands Missile Range. The focus is on those activities that took place at White Sands before, during, and since the initial lean implementation activities. Lean implementers, White Sands leadership, members of the workforce, planning documents, and reports related to lean activities were key sources for the analysis. Detailed examination of lean activities at other Department of Defense and Government agencies was beyond the scope of this research. Certain specific representative information concerning other Governmental lean efforts was considered as part of background development and as a basis for high-level contrast and comparison.

F. METHODOLOGY

1. Data Collection Methodology

The research involved face-to-face interviews with key leaders and managers, as well as participating members of the workforce. Collection of documents used for planning and conducting lean events as well as reports and data generated after these events contributed to the data set. A comprehensive survey of lean implementers, essentially members of the White Sands workforce at large, was conducted to gather detailed information about their perceptions during the actual implementation process.

2. Data Analysis Methodology

We analyzed data obtained from interviews and surveys to identify processes used, issues, obstacles, and lessons learned by those participating in the lean implementation. We then compared these “personal outlooks” to commentary on documented lean improvement events and the subsequent metrics that were collected to measure their effectiveness and impact. Our intention was to corroborate expectations, hypotheses, and initial lean objectives at White Sands with tangible outcomes of the implementation process. Examining commentary of individuals, who were experts in the planning and after-event documentation, provided valuable insight into event goals and actual success of lean activities.

3. Conclusions and Recommendations Methodology

We derived conclusions and recommendations based on the data analysis. These results should enable other Government organizations to implement lean with an up-front understanding of the potential challenges and an increased opportunity for success, increased efficiency, cost savings, and higher quality of service.

G. RESEARCH PROJECT REPORT ORGANIZATION

The research project report is organized into five chapters.

Chapter I: Introduction – This chapter presents the purpose, background, objective, research questions, scope and limitations, methodology, and organization of the report.

Chapter II: Background – This chapter begins with a high level overview of White Sands Missile Range, presenting a synopsis of its physical, organizational, and functional aspects. Concepts of lean thinking as well as some recommended processes for implanting lean are introduced. The Army’s commitment to lean and some associated interpretations are examined through references to official documents and anecdotal observations about lean efforts around the Army. The chapter concludes with the “story of lean” at White Sands Missile Range, giving an overview of its inception, time line, and current status.

Chapter III: Data Presentation – This chapter describes the data collection process used during face-to-face interviews with White Sands personnel involved in lean implementation, and in the development and administration of a comprehensive survey of lean implementers. The data is presented in descending order of a data organization model and in order of major emerging themes.

Chapter IV: Data Analysis – This chapter presents an analysis of data from Chapters II and III. It evaluates the processes used and the obstacles, issues, and lessons learned by lean implementers. It is organized in the same descending order of a data organization model and the benefits and issues associated with those major themes.

Chapter V: Conclusions and Recommendations – This chapter presents conclusions and recommendations for successful implementation of lean in a government organization, based upon the analysis represented in Chapter IV. It is similarly organized around the same themes as chapters three and four, arriving at logical conclusions and recommendations directly supported by the data and analysis.

Appendices contain an acronym list and full synopsized data presentation.

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II. BACKGROUND

A. OVERVIEW OF WHITE SANDS MISSILE RANGE

White Sands Missile Range (WSMR) is a unique tri-service installation facility dedicated to the Test, Evaluation (T&E) process, research, and the assessment of military weapon systems and commercial products. The Range offers a diverse assortment of missile and system of systems (SoS) testing capabilities and infrastructure that represent the largest land-based open-air missile range in the Department of Defense (DoD). Distinct among these capabilities are state-of-the-art environmental testing chambers, an extensive data collection instrumentation suite, advanced data processing, and modeling & simulation (M&S) facilities. This places WSMR in an inimitable position to address present and future challenges facing our warfighters and to provide support for the Global War on Terrorism (White Sands Missile Range, 2001).



The WSMR mission is to, "...provide DoD Army, Navy, Air Force, and other customers with high quality services for experimentation, test, research, assessment, development, and training in support of our transforming military and our nation at war." Its vision is fourfold and embodied in the following statements:

- The warfighters engaged in the global war on terrorism are our ultimate customers. We will rapidly adapt to their evolving needs.
- We will become the premier joint test and training complex for component, integration, and system of systems efforts.
- We will be recognized as the most innovative and flexible solutions based service provider.

- White Sands Missile Range will be the most desirable place to live and work (Business and Technology Development Directorate, 2006).

In addition to the Army's core values of loyalty, duty, respect, selfless service, honor, integrity, and personal courage (Spisak, 2006); White Sands emphasizes customer service, teamwork, and stewardship.



WSMR is part of the Developmental Test Command (DTC), which reports to the U.S. Army Test and Evaluation Command (ATEC). White Sands is designated as a DoD major range and test facility base (MRTFB) (Wolfowitz, 2002). The range possesses extensive facilities and infrastructure used by the Army, Navy, Air Force, NASA and other government agencies as well as universities, private industry and some foreign militaries. Those facilities and infrastructure are spread

across an expansive land area in the Tularosa basin of southeastern New Mexico. White Sands exclusively owns approximately 3,200 square miles of territory within its proper borders. Unique lease agreements with landowners on the western and northern borders of White Sands provide “call-up” areas that add another 2,343 square miles to this area. Partnering with Ft. Bliss to the south and east provides another 1, 562 square miles beyond that.

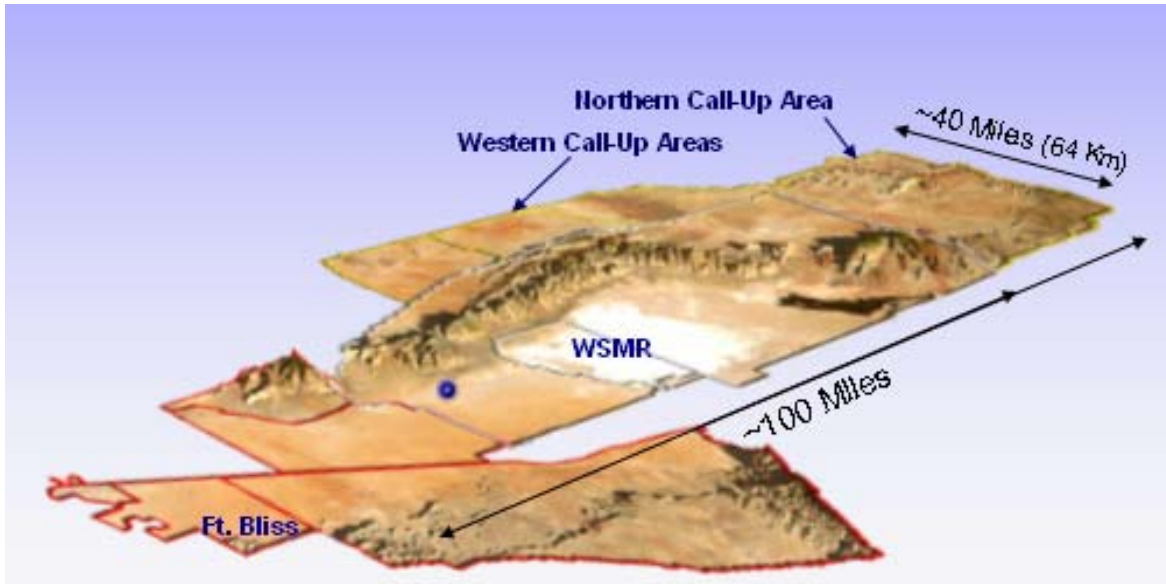


Figure 1 – White Sands Land Area

The White Sands organization is divided into the White Sands Test Center encompassing the open air missile range operation, technical services and laboratory facilities, and the White Sands Garrison, providing base operations and maintenance of the military post. The Air Force and Navy maintain significant presence at White Sands through O6 level deputies reporting immediately to the WSMR Director. A host of tenant activities are also quite active at White Sands including the National Aeronautics and Space Administration (NASA), the Training and Doctrine Command (TRADOC) Analysis Center, the High Energy Laser Test Facility (HELSTF), the Defense Threat Reduction Agency (DTRA), the Army Research Laboratory (ARL), the Center for Counter Measures (CCM), the National Geospatial Intelligence Agency, Test Measurement and Diagnostic Equipment, The Army Contracting Agency, and a Civilian Personnel Advisory Center. These diverse organizations employ 2711 DoD civilians, 432 military billets, and 3447 civilian contractors. Along with 700 family members, 250 Student Co-Ops and summer hires, and the recent addition of an 80-member cadre of support personnel for the Future Combat System, the total “noon-time” population at White Sands is approximately 7,620. The total budget for these activities exceeds \$600M, providing more than \$1.8M per day in economic impact to the surrounding communities of Las Cruces, NM, Alamogordo, NM, and El Paso, TX. The Test Center

and WSMR Garrison were the two organizations most notably engaged in the lean effort that is the subject of this study. Our focus will be on the experiences, outcomes, issues, and lessons that can be gleaned from their efforts to implement lean thinking within their ranks.

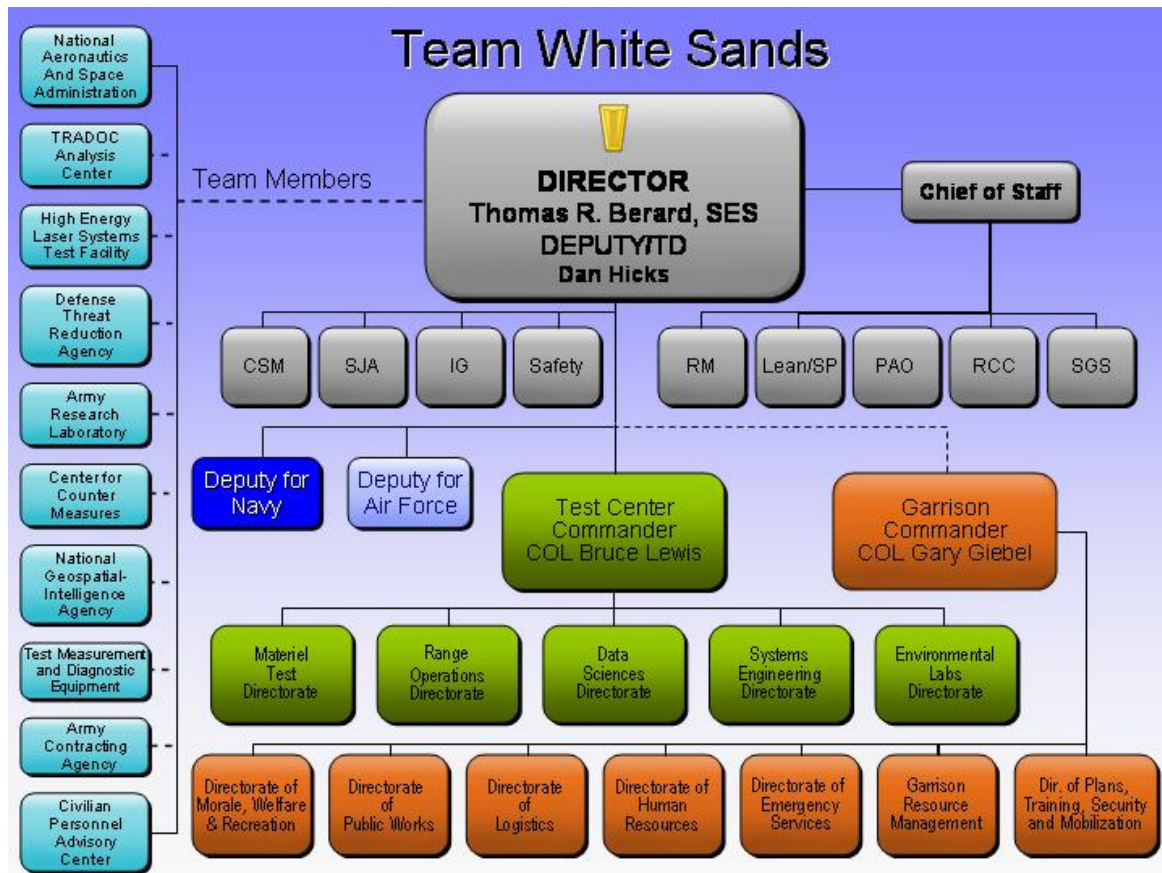


Figure 2 - Organization

B. WHAT IS LEAN?

Lean is a philosophy and methodology to reduce waste in processes. Lean manufacturing is a systematic approach to identifying and eliminating non-value added activities through continuous improvement of processes. The term lean, when applied to production management, emphasizes elimination of waste throughout an operation. In the 1980's, Toyota's "Just In Time" production technique was adopted as a better manufacturing concept; replacing Ford's mass production factory techniques which had been practiced since the early 1900's. In the 1990's, lean replaced Just In Time (JIT) as

the most significant production management improvement of the past 50 years. Lean production was developed in Japan and embodied by Toyota. Lean production was designed to improve quality and achieve high volume production, while eliminating waste. It emphasizes using minimal inventories, where parts arrive “just in time” and nothing is produced until it is needed (Womack, Jones, Roos, 1991).

James Womack and Daniel Jones described lean thinking in their 1996 best seller *Lean Thinking – Banish Waste and Create Wealth in Your Corporation* (Womack & Jones, 2003) as a powerful tool for creating value while eliminating waste in any organization by removing needless activities. Womack and Jones, “concluded that lean thinking can be summarized by five principles: precisely specify value by specific product, identify the value stream for each product, make value flow without interruptions, let the customer pull value from the producer, and pursue perfection.” Automotive and manufacturing companies, as well as administrative businesses have successfully employed these management improvement principles. Lean is about doing more with less. Lean thinking is about improving the process, resulting in increased efficiency, lower cost, and higher quality for the customer.

Value is the product or service desired by the customer or user. Lean thinking attempts to define value in terms of specific products or services with specific capabilities or results, offered at specific prices to specific customers or users. That which has no value is waste. The Japanese define waste as “muda,” specifically any human activity that absorbs resources but creates no value. Examples of muda include: mistakes which require rectification, production of items no one wants so that inventories and goods pile up, processing steps which aren’t actually needed, movement of employees and transport of goods from one place to another without any purpose, or goods and services which don’t meet the needs of the customer. These are all instances of waste.

Creating value implies establishment of an appropriate value stream. A value stream is that set of activities or steps of a process that produce the product or service required by the customer. Efficiency requires a value stream consisting of steps that only add value as the inputs are processed. Any steps that do not add value or are pure waste

are either eliminated or improved in order to make the value stream more efficient; often resulting in dramatic cost savings and increases in efficiency and productivity.

Flow describes the way that inputs or products advance through the value stream from value-adding step to value-adding step. Optimal flow has no bottlenecks or excess inventory, nor does it have unused capacity. Process steps should not be overwhelmed or idle. So once value has been precisely defined, and the value stream for a specific product fully mapped by the lean enterprise with obviously wasteful steps eliminated, the remaining value-creating steps must be made to flow efficiently and continuously through the line. This flow must cast aside traditional paradigms based on functions, departments or other organizational stovepipes, avoid “batch and queue” thinking, and move toward value-creating processes to achieve the steps in a value stream. This process enhancement is an example of “kaikaku,” a Japanese term meaning “radical improvement.”

Having achieved the steps just described, an organization will be ready to design, schedule and make exactly what a customer wants, when the customer wants it. This is how customers pull products from the manufacturer; such that no one upstream on a line will need to produce anything until components down the line need, or pull, them in an appropriate way. Through this pull technique; production need is initiated by actual demand. There is no need to build up expensive inventories, or huge stocks of products that no one wants or needs. Pull is the action by a downstream activity that causes an upstream activity in a value stream to produce its product. Optimally, we want the customer to pull his product from our value stream so that there is no standing inventory waiting for a customer.

Once organizations accurately define value, identify the entire value stream, make value-creating steps flow continuously and let customers pull value from the enterprise, it becomes obvious that there is really no end to the process of reducing time, effort, space, cost and mistakes and the idea of continuous improvement, or “kaizen”, becomes a realizable goal. The fifth and final principle of lean thinking is the pursuit of perfection. Perfection is what we continuously strive for in optimizing our value streams. It is the goal that while never achieved is never abandoned.

Lean thinking is not just a manufacturer's tool. Lean thinking is about improving processes or sets of actions. Companies looking for overall improvements have seen that lean is also applicable to businesses executing mainly administrative processes. Lean thinking can reduce waste: waste of time, money, and supplies. It can save time, reduce cost, and improve quality and timely delivery of products and services.

Recently, lean has begun to be more commonly grouped with six-sigma, another quality improvement instrument. The objective of six-sigma is to obtain high performance and reliability, and achieve an outcome of increased profit or cost efficiency. Six-sigma, teaches variation reduction and making of customer-focused, data driven decisions. Organizations use six-sigma as a business initiative to improve quality, productivity, and increase profits by creating a heightened awareness of the need for ongoing and everlasting quality improvement efforts (Chase, Jacobs, Aquilano, 2006).

Lean six-sigma is the theoretical combination of lean and six-sigma as we have described them above. This combination seeks to bring together the strengths from each process to increase quality, shorten response time, and create value throughout the organization. Lean thinking will reduce cost and shorten process time, while six-sigma improves on product or service quality. In combining these two methodologies, organizations hope to provide faster service while sustaining superior products.

The Army has begun to use the term "lean six-sigma" to represent this kind of blending. We recognize that there is a difference between lean six-sigma, six sigma, and lean. We include information about six-sigma and lean six-sigma to emphasize the distinction and to highlight the fact that this case study will concentrate on a pure lean implementation at White Sands. The data collection and analysis will treat it as such and will concentrate on that period of time when lean alone was being employed.

C. RECOMMENDED PROCESSES FOR IMPLEMENTING LEAN

The recommended steps for implementing lean in an organization include the very important step of utilizing an expert, sensei, or consultant who is experienced in implementing lean to guide you through the initial stages of deployment. The period that

this expert is involved might vary, but it is widely agreed that this is a critical step. Experience has shown that those organizations that do not use outside assistance and instead try to employ lean on their own regularly meet with failure.

WSMR utilized a lean consulting contractor in this capacity. This contractor is a company that provides expert assistance for organizations initiating lean activities. The staff is composed of only those people at a vice president level who have successfully implemented lean in their organizations. These are people who have had an impact on industry in some of the leading companies employing lean. Many have first hand experience with the pioneers of lean from Toyota. Needless to say, they came to WSMR with impressive credentials.

The contractor's method of deploying is initiated via a training session with high-level managers to provide the path ahead. As part of that training the consultant indicates the necessary steps for implementing lean. These steps are in accord with tenets as described in *Lean Thinking* (Womack & Jones, 2003). An interesting fact is that the company is quite hesitant to be contracted for support unless their recommended process is fully agreed to.

A key aspect of their approach is to work through the top executive. This accentuates the need for a change agent, either that executive or another designee. This approach is clearly in line with standard lean thinking which stresses the importance of high-level support and change agents. The consultant stressed the importance of launching lean through upper management in order to clearly establish the focus and objectives and to identify what success looks like for the organization.

There are additional deployment steps utilized by the contractor and described in *Lean Thinking* (Womack & Jones, 2003). Policy deployment is that detailed discussion and agreement on what management "wants" from lean. Examples might be increased productivity and reduced lead-time. These things needed to be clearly understood by upper managers before proceeding. Additionally, the consultant stressed the need to train key participants. An especially important step was to establish a full-

time deployment team. The consultant highly recommended White Sands establish a core implementation team prior to initiating lean activities.

The importance of a comprehensive communication campaign as described in *Lean Thinking* (Womack & Jones, 2003) was stressed. The training identified the need to share the vision and describe the benefits for all involved in a multi-faceted campaign. This campaign purposed to share the vision of lean by answering some key questions.

- Where are you going? And why?
- What's in it for me?

Additionally, the campaign is multi-faceted, internal advertising utilizing such communications means as:

- All hands meetings,
- Company newsletter,
- Lean information centers,
- Company web page, and
- Local news channels.

White Sands was encouraged to set an aggressive pace in its lean activities, a practice reflected by successful lean implementations. Once a plan was devised, the consultant gave the go ahead to execute. The first key activity was to conduct a high-level value stream analysis (VSA) of the core mission process at White Sands.

The activities that followed from the VSA are referred to in *Lean Thinking* (Womack & Jones, 2003) as “kaizen” or what the consultant calls rapid improvement events (RIEs). This is the systematic approach of attacking those areas of the value stream that need improvement. The need for an expert to facilitate the lean activities was very clear by this point, especially as the different types of lean events were discussed.

Finally, the consultant stressed the need to measure and evaluate the effects of lean in order to determine if the objectives established by management were being met. Metrics are key in evaluating process improvement as described in *Lean*

Thinking (Womack & Jones, 2003) and emphasized by the consultant. The presence or absence of incremental and continuous improvement is made evident by consistent gathering and analysis of metrics.

D. LEAN AND THE ARMY

At its highest level, Army leadership is clearly committed to implementing principles of lean thinking across its ranks. This commitment is best reflected in major points from Secretary of the Army Francis Harvey's memo (Harvey, 2006).

The Army's policy is clearly articulated here, in concert with the prosecution of the GWOT and the transformation of both the institutional and operational forces. We see the continued "blending" of lean and six-sigma, as discussed earlier, with an up-front assertion of success at the Army Material Command that Secretary Harvey believes can be "duplicated throughout the Army" (Harvey, 2006, p. 1). The Secretary stresses that all programs and locations are subject to the application of lean. He directs senior leaders to engage directly in lean implementation with the collective mandate of "...the daily deliberate pursuit of increased effectiveness and efficiency" (Harvey, 2006, p. 3). Interestingly, the Secretaries of the Air Force (Wynne, 2006) and Navy (Winter, 2006) have issued similar lean deployment memoranda indicating a broader focus on lean thinking at the highest levels of the DoD.

On a more practical level, the Army Knowledge Online and AMC lean six-sigma homepages showcase several glowing anecdotal descriptions of lean successes. At Letterkenny Army Depot – "...The depot announced that a massive streamlining will allow about 30 extra Humvees to roll through the production lines each month. " This is a big deal. Nothing in this world is free, but this is," said Maj. Gen. James Pillsbury, surrounded by a fleet of 27 Humvees" (AMC Lean Six-Sigma, 2006, p. 1). At Red River Army Depot – "...The goal of the initiative was to increase their output from less than one vehicle per week. There was steady improvement over the next 9 months. By September 2005, Red River Army Depot reached 100 vehicles per month, while at the same time improving delivery time by a remarkable 75%. These efforts have resulted in

\$30 million in cost avoidance in FY05” (AMC Lean Six-Sigma, 2006, p. 1). At the United States Army Security Assistance Command (USASAC) – “...USASAC has shown the lean six-sigma is not just for manufacturing. Since 2004, USASAC has used lean six-sigma to improve the processes involved in foreign military sales. The results have reduced lead times by 25% and improved the quality of the processes, while cutting administration costs by \$3.2 million” (AMC Lean Six-Sigma, 2006, p. 1). The Armament Research Development and Engineering Center (ARDEC) “...applied lean six-sigma to PAX-2a explosive quality issues. When the PAX-2a explosive was loaded into M77 grenades, the explosive material stuck to the grenades’ explosive parts and heavy spillage occurred. This caused a major safety issue, higher production costs and lowered production output. Applying lean six-sigma to eliminate the problems resulted in future cost savings of \$1.2B” (AMC Lean Six-Sigma, 2006, p. 1). These are just as a few examples advertised from across the Army.

In our research we came across many, many such high level, very positive anecdotal references, scores of how-to, general guidance, training, or other implementation aids, but hardly a single in-depth, case study detailing the actual personal, physical, functional and institutional outcomes of a lean implementation in Government/Military environment, be they good or not-so-good.

At White Sands, we see the Army’s commitment to lean reflected in the Commander’s guidance message dated 8 Nov 2004:

From: (CG)

Sent: Monday, November 08, 2004 4:58 AM

Subject: RE: RM LEAN VSA: Training (Nov4), Actual Event (Nov 8-10)

I want to emphasize a few points to each of you.

First, this is a very important three days for the White Sands Test Center. Our Lean Enterprise efforts will progress from the bottom up. This is different from earlier attempts to change the way we operate at White Sands. Teams, sections, branches will tell management how they believe they can best operate in support of our customers.

However, we will not be able to choose the right activities unless we can map the value stream effectively. We need your help to do that.

Second, we are not looking for ways to cut people from the Test Center or the headquarters. If our detailed review of the work indicates we are over-staffed in an area,

we will consider options of business as usual, creating another identical team to process work twice as fast, moving individuals to other areas where they are needed more, or some other action. We are not trying to lower the size of the test center and I am committed to not forcing people to leave on terms other than their own.

Third, try not to focus on the software programs we use to do our business. Identify how work is done, how it should be done, and the steps we should take to get from one to the other. We are not forced to do our business the way WISMIS, SOFIMS, or SOMARDS operate. I agree we must provide data and reports in particular formats required by these programs, however, it's up to us (to you) to decide how we should operate.

Fourth, your work is important because we must implement the recommendations (and will do so within a few days/weeks of the RIEs). We will not study the results to death and we will not put them on the shelf. We need to make sure up front, that we are choosing the right areas to review.

Fifth, if you think Lean Thinking applies only to business you are wrong. Lean is a technique of reviewing a process. We are not as effective and efficient as we should be. As a result, we waste time and money every day. We do not have the time or experience necessary to review all our processes by ourselves. The Lean Team can help us. We owe it to our customers and the Army to spend the funds we receive as effectively as possible.

Last, it was important enough to me and the Test Center leaders to have each director and a number of other leaders in the last VSA. It is important enough to have you focus on this effort for three days. I need the experience you have applied to this VSA; need your willing and active participation this week and beyond.

Thank you for your support.

Lean thinking was embraced by the former White Sands commander as indicated in his message shown above. He established a lean implementation office reporting directly to his headquarters staff, and was personally engaged in their extensive and far-reaching lean implementation activities. The lean office conducted a large number of implementation events (Rapid Improvement Events, Value Stream analyses, and Projects) over a period of about 1 year. They kept substantial records and collected associated metrics. These records were important to our research, along with interviews and surveys of the leadership in place during this time, and personal observations of the individuals who were actually involved in the events.

E. CHRONOLOGY OF LEAN AT WHITE SANDS

The commander was the change agent for the lean implementation at White Sands Missile Range. He was the initiator of the program and the driving force and energy behind the early activities.

There were at least two fundamental reasons for the White Sands commander to undertake a lean transformation. His “burning platform” was a set of critical situations that needed to be dealt with before something more catastrophic happened – specifically, a significant, anticipated funding shortfall, and a lingering dissatisfaction on the part of some White Sands customers.

The need to be more efficient, do more with less, and offer more services to our customers as a way to bring more revenue to the Range was a driving motivation for implementing lean. It was also important to eliminate any higher-level customer complaints arising from poor customer test support. Finally, there was a need for an increased quality orientation and pursuit of excellence among Range employees.

The timeline for the initial implementation of lean at White Sands, in keeping with the lean consultant’s guidance was as follows:

- The Commanding General, WSMR, directed the initiation of lean in the summer of 2004.
- A lean consulting contractor was hired for lean implementation support and facilitation by early fall 2004.
- White Sands established an initial lean activity in August.
- The members of the lean office participated in various web-based training classes and read *Lean Thinking* (Womack & Jones, 2003) in order to become familiar with lean.
- A core lean team was recruited consistent with the lean consultant’s guidance of one to three percent of the workforce by mid-September.

- On September 22, the consultant conducted an executive launch for senior management that included training and briefings in preparation for the initial value stream analysis. This forum established the objectives for the lean implementation at White Sands.
- On October 18, White Sands conducted its first lean event, a value stream analysis (VSA) of the core test support process used by the range. The participants of the VSA were the same managers that attended the executive launch. The action plan that resulted from the VSA was the basis for the first six months of rapid improvement events. These were conducted at a pace of three to five per month.
- Over the course of the next two years 52 lean events were conducted and documented. This activity is the object of our case study.

III. DATA PRESENTATION

A. DATA SOURCES AND ORGANIZATION

The data for our case study was derived and collected from two primary sources; personal interviews of top management and significant participants in lean activity at White Sands; and a comprehensive survey that embodied the same questions as those asked in the personal interviews, distributed to every participant in a lean event at White Sands. We have carefully considered the organization of our data both during collection, and presentation in this chapter, to facilitate its examination and analysis. As a result of that consideration we arrived at a simple and useful model of organization for the data that provided an excellent conceptual framework for its collection and correlation. A graphical representation of the model is as follows:

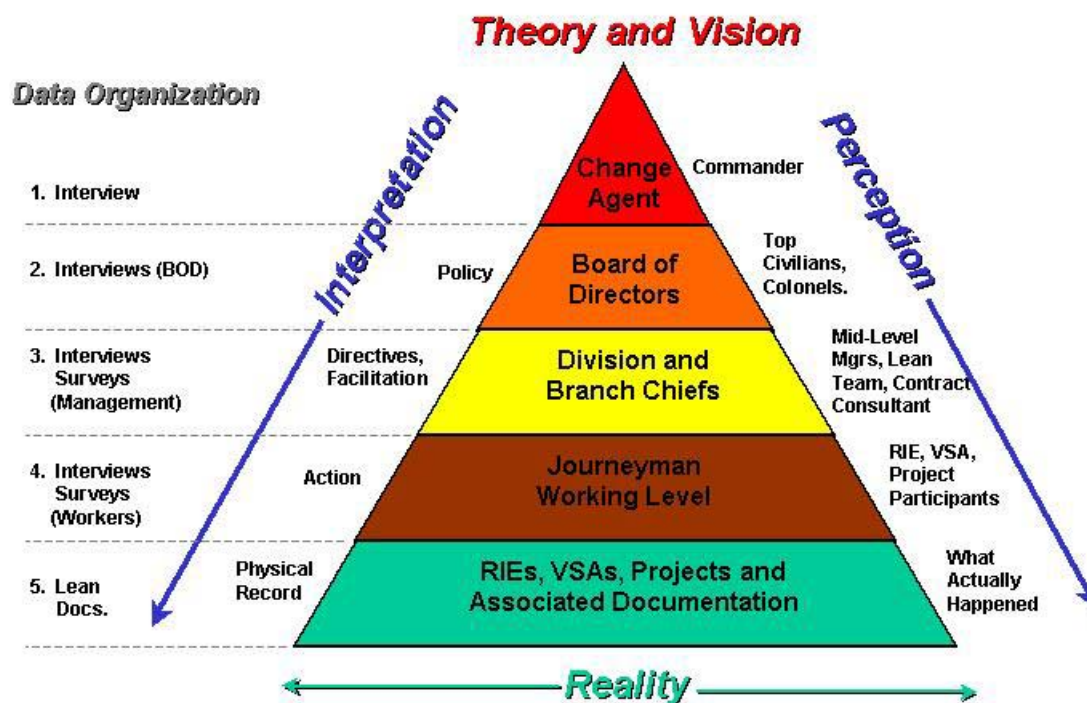


Figure 3 – Data Organization Model

This model organizes the data in a top-down structure beginning with the change agent, the former White Sands commander, and proceeding through the Board of

Directors, Branch and Division Chiefs, and on through journeyman level workers who were actually executing lean events, culminating at its base with the wealth of documentation that they generated in their efforts. At the top of this structure we would expect to find theory, vision, and expectation as major themes, given that the purveyor here was the top-level leader at White Sands and a strong proponent of lean thinking. As more data was collected down the organization structure of the model, we would expect to find increasing levels of interpretation resulting in the development and implementation of policy and practice, accompanied by increasingly varied perceptions of those interpretations as the data sources get further away, in actual everyday practice, from the change agent. At the bottom of the structure lies the actual hardcopy information collected during the execution of lean events. This layer, consisting of RIE brief-outs, recommendation papers, metrics reviews and other documents, is a record of “what actually happened,” and is a snapshot of reality as affected by the lean implementation process at White Sands. At each level we have collected data in the form of interviews, interviews combined with survey results, and finally some information on hard lean documents themselves.

B. DATA COLLECTION PROCESS

To gain insight into individual knowledge, perceptions, and assessments of lean at White Sands, we developed a set of interview questions designed to objectively solicit key information through personal interviews with high-level executives within White Sands’ management. These questions focused on a range of issues we believed were pertinent to the lean experience at White Sands. Carefully considering these issues, we developed the following set of specific questions with the intention of using them as the framework to conduct uniform and identical interviews among participants. The specific list of interview questions we used to conduct our interviews was as follows:

1. Are you:
 - a. Upper management (GS-14-15)
 - b. Mid-management (GS-13)
 - c. Working Level (Up to GS-12)
 - d. Part of, or formerly a part of, the lean office

2. Was there a compelling reason to use lean at White Sands? What was it? (your opinion)
3. Was there a vision for lean at White Sands? What was it?
4. Was there urgency to implement? How would you describe it?
5. Were there stated goals? What were they?
6. Was benefit anticipated? What were your expectations?
7. Was lean generally supported at White Sands? At what levels?
8. Was lean support by upper management? How could you tell?
9. Was lean initiated effectively? How was this done?
10. Were you involved? In what way?
11. Were you trained in lean?
12. Was lean successful at White Sands? Why/Why not?
13. Were there problems with the implementation? What were they?
14. Did you participate in the initial Value Stream Analysis? How did that go from your perspective?
15. Were you involved in any Rapid Improvement Events? What was that involvement?
16. Did outcomes match up with stated goals? To what degree?
17. Did the workforce have impressions of lean? What were they?
18. Were there problems/obstacles/issues with lean? What were they?
19. Could anything have been done differently, based on those? What?
20. Were there benefits from lean? What were they? How were they measured?
21. Was there a cost associated with lean? What do you think it was?
22. Do you have a personal opinion of lean? What is it?

23. Should lean continue to be used at WSMR? What is your recommendation for continuation?

In developing these questions we were also considering mechanisms that could be employed to conduct a wider survey among the White Sands workforce, seeking similar information. We quickly concluded that a set of questions that was also uniform across the survey would be ideal in terms of data organization and analysis. With this in mind we modified the questions to be in a “yes, no, don’t know,” form, followed by an opportunity to elaborate on the initial response.

As interview subjects, we selected a group of key leaders who are, or have been, intimately engaged in lean implementation at White Sands. We selected these participants following our top-down data organization model, choosing experienced and representative individuals from each of the model “bands.” We were also particularly concerned about protecting the privacy interests of the individuals who participated in these interviews. To comply fully with regulatory requirements governing the use of human subjects in research, we prepared a Privacy Act Statement, Interview Release Participant Consent form, and copies of our interview questions for approval by the NPS IRB Committee for the Protection of Human Subjects.

We have taken great care in our effort to capture the very subjective breadth and depth of information gathered during the interview process, while ensuring that no attribution or misrepresentation is introduced into that material. We believe it is quite important to document the hierarchical level at which this information was gathered, as a confirmation of the significance and pertinence of the data. Our list of “generalized” participants with brief biographical descriptions that speak to that hierarchical level, follows:

Change Agent – SES Civilian Director of White Sands Missile Range. This individual succeeded the former military commander and has been vested with continuing to champion lean activity at White Sands. Formerly the Technical Director at another MRTFB, this individual is in a unique position as the first civilian “Commander” at White Sands.

Board of Directors #1 – Commander of the White Sands Test Center. This individual had just arrived at White Sands, having recently completed some high-level business training at the Army War College, giving them a valuable “outside” eyes perspective that we hoped to capitalize on.

Board of Directors #2 – Technical Director of White Sands, formerly a director, division, and branch chief.

Board of Directors #3 – White Sands Executive Director. This individual has been with the White Sands Headquarters Staff for many years and made their way through the ranks as a missile flight safety officer in White Sands’ operations organization.

Director #1 – Former Chief of the White Sands lean office, stood up specifically to initiate and facilitate lean implementation at White Sands. This individual has an engineering background and rose through the ranks as a software systems developer. Formerly a deputy director.

Director #2 – Director of Range Operations at White Sands. Like the Executive Director, this individual made their way through the ranks as a missile flight safety officer in the operations directorate, and has also had significant experience with off-range programs in support of other agencies.

Division/Branch Chief #1 – Current chief of the White Sands lean office. Vested with managing lean at White Sands in light of emerging Army and DoD guidance on lean.

Division/Branch Chief #2 – A division chief in operations. This individual has an engineering background having made significant innovations in the field of instrumentation development. This person was an early supporter and participant in lean events at White Sands.

Journeyman Worker – This individual worked in the original lean office coordinating and facilitating lean events, providing first-line training to participants in

lean events, and documenting the conduct, and results of those events. This person's background is in facilities maintenance and logistics.

We took detailed individual notes of each interview, with emphasis on capturing key points, quotations, examples, and observations that arose during the dialogue surrounding our interview questions. Using those notes, and referring to our interview recordings, we have paraphrased the combined interviews for presentation in this chapter. In close coordination with our advisors we spent a great deal of time strategizing how we would appropriately represent such a large, subjective and potentially controversial body of material, such that it is synopsisized sufficiently without being over-interpreted on our part, and presented in a neutral and academically useful form. We also had to take great care in not attributing quotations or references to any particular individual. We stress that there is no association or significance to the order, sequence, or grouping of the material. We have included compelling quotations in support of our synopses, again being careful not to attribute those quotations to any specific individual.

We quickly concluded that a uniform set of questions across both interviews and surveys would be the most effective research tool for this case study. Referring largely to the Statistical Solutions Inc. Survey Research guidelines (Garson, 2006), we refined our questionnaire to address critical considerations of neutrality and scientific or statistical significance in organization and structure. Those considerations included:

- Order – introducing the survey with non-threatening demographic information and items of a more general nature
- Bias – structuring questions to eliminate ambiguity, mutual exclusivity, a non-exhaustive response set, social favorability, loaded terms, leading questions, unfamiliar terms and jargon, compound language clauses, gender favorability, and hypothetical items.
- Question and survey length – balancing a comprehensive set of questions with a reasonable projected response time that would increase the overall rate and quality of responses.

- Survey layout – providing an attractive, easy-to-use, non-intimidating format that incorporates plenty of white space and consistent appearance.

With these considerations in mind we, we structured all the questions to require a simple yes or no initial answer, added an “I don’t know,” or “no opinion” response to eliminate mutual exclusivity, shortened the questions considerably in the interest of simplicity and then ordered them from more general to more specific in their solicitation.

The DoD has certain regulatory requirements governing the use of surveys within the military services which are enforced through their Inspectors General (IG). We were fortunate at White Sands to have had our IG engage a contractor, NCI Inc., to create a tool specifically designed to administer surveys to their specification, as confirmed by the Survey Approval Authority: U.S. Army Research Institute for the Behavioral and Social Sciences, Survey Control Number DAPE-ARI-AO-05-20 RCS: MILPC-3. The White Sands IG subsequently used this tool to administer their White Sands Climate Survey for FY06. We were able to take advantage of this tool as the mechanism for administering our survey. We directly input our Privacy Act Statement, Survey Participant Consent, and questionnaire to produce an extremely professional, web-based survey mechanism that guaranteed anonymity and would automate the data collection and archiving process.

A link to the web-based survey tool was emailed to every employee at White Sands who had participated in a lean event, as determined by examining the records of individual lean events that included participant lists. This message explained our objectives, affiliation with NPS, our commitment to guarantee of privacy and anonymity, and a specific appeal for individual participation based upon known experience with lean at White Sands. To complete the survey, a respondent needed only to follow that direct link and follow the self-explanatory instructions. Some screen images from the actual survey tool are provided to highlight its form and appearance.



WHITE SANDS MISSILE RANGE

Quality Test And Evaluation For Over 60 Years...

Are you:

- ☐ Upper management (GS-14-15)
- ☐ Mid-management (GS-13)
- ☐ Working Level (Up to GS-12)
- ☐ Part of, or formerly a part of, the Lean office

Was there a compelling reason to use lean at White Sands?

☐ Yes ☐ No ☐ Don't Know/No Opinion

What was it? (Your opinion)


Was there a vision for lean at White Sands?

☐ Yes ☐ No ☐ Don't Know/No Opinion

What was it?

[Back](#) [Next](#)

Page 1 of 12



WHITE SANDS MISSILE RANGE

Quality Test And Evaluation For Over 60 Years...

Was there urgency to implement?

☐ Yes ☐ No ☐ Don't Know/No Opinion

How would you describe it?

Were there stated goals?

☐ Yes ☐ No ☐ Don't Know/No Opinion

What were they?

[Back](#) [Next](#)

Page 2 of 12

Figure 4 – Survey Screen Shots

There were 36 respondents to the survey. The survey data was compiled and charted showing the number of people answering yes, no, and don't know/no opinion. Additionally, the written comments associated with each question were synopsisized and considered in our analysis. This detailed survey data is available in its entirety in Appendix I.

C. DATA

A massive and varied body of information was collected from interviews and survey responses – far greater than can be presented in any great level of detail in this forum. We have chosen to represent the data in this chapter as it relates to our most significant and consistent findings, and organized under subheadings that directly support our analysis and conclusions and recommendations. We will begin each subheading with a summary of data pertinent data points followed by bulleted lists of supporting quotations or survey data elements. For the benefit of those that may be interested in specific details within that body of information, we have included the full synopsisized data set in Appendix I.

1. Linkage Between Lean and Personnel Cuts

Persistent throughout both survey and interview data we found frequent references to the perception of a linkage between lean activity and job cuts, personnel reductions, retirements, getting rid of people and getting rid of jobs. Representative data elements that illustrate this point are as follows:

- “The vision for lean was to make it a part of the culture and provide... everybody with tools they need to look at their process and their work to find efficiencies and improve the product they are providing to our customers. But there was a problem tying this to VERA/VSIP and personnel or workforce reductions.”
- “There was urgency. Part of the problem was tying that urgency to letting people go to meet VERA/VSIP goals.”

- “There was the view that it was a means of getting rid of people, with solutions being forced upon them from up the chain. The commander started talking about budgets and VERA/VSIP and ways to do more with less people.”

2. Management Support of Lean

Commentary on support of lean varied across the board, but trended overall toward comments or observations about management support at the levels between the change agents and the working level. There were many references to lukewarm, superficial, or inconsistent support, inconsistent understanding, and resistance to change among management, as contrasted to the change agents and lean implementers. These issues were seen to moderate among those who had greater participation and experience with the lean process. Illustrative points from the data set are:

- “Lean was supported by grass-roots level personnel - the folks that had a vested interest in improving the way the work gets done. Not by the management at large. Managers stand the most to lose by a change initiative, and lean must be driven down from the top.”
- “My experience was that it was supported at the participant level; however, management support was only superficial”
- “Upper management was lukewarm also. We have believers and non-believers. In general they are trying, but I’m not sure they all believe.”
- “They supported it with people and time, but didn’t communicate it.”
- “Directors began to take more things on themselves and were more proactive. There was a diligent attempt to make the time for lean events. The management listened well, encouraged teams, and was supportive of team’s results.”
- “Management is now turning to the process to get things done, like the reimbursable budget. There’s more ownership now.”

- Survey respondents gauged management attitudes about lean by attendance at event out briefs, implementation of recommendations, and providing support to lean activities.
- “I think it would have been good to be part of an RIE.”

3. Small Incremental Benefits versus Large Bottom-line Impact

Survey and interview responses are rife with references to the contrast between expected large efficiency gains and savings, and the smaller, more difficult to measure incremental gains that actually resulted. There was unanimous agreement that some benefit was realized from nearly every lean activity, though it may not have been very tangible in terms of White Sands’ bottom line. There was a broad understanding of incremental change with respect to efficiency and elimination of waste as objectives of lean, without much reference to immediate bottom line impacts from such change. From the data set we highlight:

- 58% of survey respondents indicated a compelling reason to use lean based upon the need to identify waste and inefficiency, determining most efficient methods and practices, improve processes, free up resources, save money, and changing the culture to one of constant improvement.
- 64% of survey participants anticipated benefits from lean including, understanding and improving processes and communication, increased productivity, involving personnel to reduce waste, and saving labor dollars.
- “We were hoping for huge benefit based on those inefficiencies, maybe twice the benefit you might expect in industry.”
- “I expected a lot of change and have seen some, but not as much as expected. I wanted a Cadillac, and wound up with a Ford, but I still have a car, so that’s OK.”
- “Anything that caused you to stop and look at what you are doing to make it better, is worth the effort.”

- “All RIEs had some level of success, but it didn’t show up on the bottom line. Lean is continuous incremental improvement. If you do this everyday things will be much improved. It was successful in producing a change climate, but failed to produce significant efficiency improvements.”
- “Lean changes are cumulative and accrue over time. RIEs should be geared towards smaller problems and smaller increments, using the tools on a smaller scale.”

4. Process Documentation

Throughout the data set we find recurring references to the lack of documented process at White Sands, and attribution of limited process improvement success to this lack. Documentation of formerly undocumented process was universally cited as one of the major benefits of lean activity. Data highlights about process documentation include:

- “One issue was that processes were not documented. We could get an immediate gain in this respect.”
- “We would find areas that don’t have a defined process, and define one. Where we had one, we would improve it.”
- “Putting together processes where there were none, was successful. We mapped processes, and got some communication going.”
- “We need a systems engineering point of view and program management point of view – not isolated projects.”
- “Lean assumed that there were defined processes. Lean just defined the processes – that’s process definition not lean. We did document and clarify some processes, but there was no great savings or efficiency.”
- “We should have documented processes first, with procedures, and checklists, and captured these before deciding to do an RIE. Many of our processes are done by a single expert with no backup, and nothing written down.”

5. Metrics and Measurement

Survey and interview respondents universally cited difficulty in defining collecting, and analyzing process metrics and using them for reporting and decision making. There were many references in the surveys and interviews, linking metrics to the ability to follow through with process improvements, and making hard determinations of value and benefit. Illustrative points from the data set that show respondent frustration with identification of the appropriate metrics are as follows:

- “We were not very successful with respect to follow-up and metrics.”
- “The first thing was that we didn’t define high-level metrics. We went on with RIEs, without knowing what to shoot for.”
- “There were two big mistakes – failure to track clear metrics with regular reporting, and a top down mentality about outcomes.”
- “The biggest problem was no metrics and no follow through. We’re having a hard time measuring cost savings.”
- “I don’t think we identified meaningful metrics that are easily tracked. We picked metrics that increased workload, and were not used to make management decisions. We needed to be able to say when to call it ‘done.’ We could have done better at looking at what higher headquarters was already requiring us to measure, as a guide.”
- “One sign of the need for lean is a lack of measurements. We needed them as a way to measure improvement and see the bottom line, day in and day out, week in and week out – this generates excitement. We didn’t stop to install metrics, and then fell back, without them.”

6. Vision, Urgency, and Goals

Participants gave a wide array of responses with respect to the vision and urgency for, and goals of lean at White Sands. Responses ranged from the need to gain efficiency and eliminate waste in the face of The Army’s Transformation mandate, declining

budgets and ever-increasing resource constraints, to changing White Sands missions, changes in the DoD materiel acquisition process, higher headquarters directives, and the T&E requirements of new systems like FCS. Significant points from the data set include:

- “From the military perspective the mandate is clear. The Chief of Staff of the Army said so, we don’t have a choice – we have to use lean.”
- “The goal was to transform the entire workforce and implement lean in all work processes - but we didn’t sit down and write that out formally.”
- “There were stated goals. I can’t tell you exactly what they were, but it was something like 10% efficiency gain and 10% cost reduction.”
- “I don’t know if there were quantifiable goals, other than making organizations more efficient and reducing overall operating costs. There were no consistent goals, across the board.”
- “This wasn’t written down, and wasn’t quantified prior to the VSA. We all knew we wanted to improve efficiency and this was tied to budget. I don’t think anything was defined, or if it was, it was not stated well.”
- “The most successful RIE I was on was very focused, with clearly defined goals.”
- “The commander was the consummate advocate and spokesman. The commander and technical director attended many events and out-briefs, and spoke to the workforce on several occasions.”
- Only 50 % of survey respondents perceived a vision for lean at White Sands.
- 61% of participants said there was an urgency to implement lean at White Sands related to the need to fix outdated and inefficient processes.
- 67% of survey participants understood some stated goals for lean at White Sands related to identifying waste, reducing costs, increasing efficiency, eliminating duplication of effort, ensuring added value, and capturing more customer money.

7. Uniquely Governmental Issues

Many survey and interview responses referred to issues concerning unique elements of the military budget process, perceived difficulty with the idea of savings and reinvestment of both fiscal and human resources, and difficulties with personnel issues that might arise as the result of lean activity. In this area we underscore the following significant data points:

- “We needed to reduce our institutional burden and address the issue with the reimbursable budget. What do you do with the savings? You can’t bank it. It’s an end of year thing. Even if you save 10% in people, what do you do with them?”
- “The primary anticipated benefit was reduction in institutional cost. Our higher command anticipated this by cutting our budget first.”
- “That perspective was tempered by the fact that higher headquarters wants a lot of lean projects and savings at the same time that they are cutting our funding and cutting our people, and the hope is that this will not compound the cuts.”
- “You could tell the level of support by the allocation of resources. If there was some uncertainty, they could withhold support and kill an effort. There were some low expectations, a ‘this has never worked before’ attitude.”
- “The outside view was a real concern about higher headquarters “compounding cuts, based on lean outcomes, which would go against their belief in reinvestment to balance off the cuts.”
- “It was another TQM or, flavor of the week.”

8. The Lean Process Itself

There were a number of references in the data to the suitability, performance and availability of the lean consultant who was under contract to WSMR and consultant personnel’s impact on the success of lean activity at White Sands; the difficulty in

adapting lean manufacturing concepts to non-manufacturing processes at White Sands; and to the perception of predetermined or predefined outcomes for improvement events. Illustrations from the data set include:

- “The effectiveness of lean in a manufacturing environment had been witnessed but it will not be easy to bring this concept to an administrative or office environment.”
- “The consultant painted a pretty picture about saving all this money. I didn’t trust the contractor – their support started with the president, went down to a vice-president, and finally the El Paso rep.”
- “There were unreasonable expectations in RIEs, that couldn’t follow their natural process, with unrealistic underlying goals that may not have been stated outright.”
- “The support contractor didn’t really understand what we do here at White Sands.”
- “Some of the lean events had the appearance of predetermined outcomes and the process was only used as a justification to implement those outcomes. The lean process determines the outcome, not the outcome using the process for justification.”
- “I’m not convinced that the contractor really understood our business and what we do. They tried to approach lean at White Sands as manufacturing, but we’re just not that.”
- “The availability of the contract consultant was hurting the number of events. Their learning curve was so great at first that it was slowing us down. We needed a full time support contractor on site, not one just popping in.”
- “Predetermined outcomes were a huge negative and will be resisted by the workforce. Any lean expectation to cut X%, is the wrong way to push the program, creating an environment of failure. It needs to be proposed as a way

to be effective with reduced resources – how to do a better job with what is at hand.”

- 72% of survey respondents stated that lean was not initiated effectively citing that predetermined outcomes or underlying agendas hindered lean events.

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IV. DATA ANALYSIS

A. ANALYSIS APPROACH

An equally massive and varied body of information was synthesized from interview data and survey responses – far greater than that required to fully support our most significant and consistent findings. We have chosen to represent the analysis in this chapter as it relates directly to those most significant findings in terms of associated benefits and issues, and organized under subheadings that are consistent with the data chapter and our conclusions and recommendations.

B. ANALYSIS

1. Linkage between Lean and Personnel Cuts

a. Benefits

Lean events often resulted in process improvements that required fewer people to do the job. Managers saw lean as a mechanism that might help identify likely personnel savings. In an environment where workforce reductions are mandated by higher headquarters or budget constraints, this benefit could help managers make informed decisions concerning reductions.

b. Issues

Almost universally, members of the workforce were less enthusiastic about participating in a lean event when they perceived a connection between that event and personnel cuts. When employees involved in lean events saw any linkage, stated, implied, or suspected, they were much more likely to resist the lean process and any resultant improvements. Lean events were often less than successful when this personnel cut linkage was present. More problematically, when the overall goal of lean implementation was linked intentionally or otherwise, to workforce reductions, the chances of success for individual events was greatly reduced.

2. Management Support of Lean

a. Benefits

Successful lean implementations were dependent on management support of the process, results, and personnel involved. When this support was present from the commander, down through management, to the workforce, the potential for enthusiastic participation and successful process improvement was most evident. Workers took their cues from managers and were much attuned to the level of support that those managers communicated, both through their actions and their words. Managers who visibly participated, communicated the vision and goals of lean, and encouraged their employees to participate had a definite positive impact on the success of lean.

Regular attendance and participation in lean events enhanced a manager's impression of lean and his or her sense of ownership in the process improvements that resulted, proportional to that attendance and participation.

b. Issues

Managers at White Sands regularly communicated mixed messages with respect to support for lean by their actions and words. Workers did not always perceive visible and consistent support by managers. The leadership's active backing or resistance was crystal clear to the watching workforce. Resistance or lack of support had a negative influence on that workforce and its desire to participate in lean. When managers did not readily accept and implement lean improvements, workers interpreted this as resistance and adjusted their own level of participation and support accordingly.

Managers who either resisted actively or were not visible in their support negatively influenced participating employees, who were interested in improving their own processes.

3. Small Incremental Benefits versus Large Bottom-line Impact

a. Benefits

Given its track record in the private sector, benefits from lean were almost universally anticipated. The commander and upper managers expected process

improvements from lean, as evident by their willingness to take on the cost and burden of the program. Indeed, the data indicates a universal acknowledgement of benefits from lean. As would be expected based on the tenets of lean, White Sands experienced a wide array and large number of small, incremental improvements. Each lean event resulted in some tangible benefit. This is the strength of lean, where a culture of continuous, and gradual improvement pursues perfection, one small step at a time, resulting in an accrual of latent benefits as lean continues to be employed. Experienced participants in lean came to expect and anticipate incremental benefit, although it was difficult to measure.

b. Issues

While some lean events had large improvements in mind, the experience at White Sands is one of incremental savings and success. No events have resulted in a significant savings to the bottom line. In fact this prospect would run counter to the White Sands experience. Stated expectations from senior managers of huge gains had the effect of coloring an event as unsuccessful even while those close to the process saw the actual, realized improvements as significant and beneficial.

4. Process Documentation

a. Benefits

Many previously undocumented processes were assessed during lean events. These activities were captured and documented in detail, which represented a significant benefit of the event. The lean tools were well suited to assist a knowledgeable team in identifying and preserving the steps associated with those processes.

b. Issues

Lean anticipates a documented process as a starting point for improvement. When this did not already exist, much time during the event had to be dedicated to this documentation activity, minimizing the opportunity for process improvement. Lean event participants were discouraged when too much time had to be used documenting a process, rather than finding improvements and savings.

5. Metrics and Measurement

a. Benefits

Properly designed metrics were critical to ensuring that efficiencies and savings from lean events were measurable and sustainable. Follow-through on specific lean recommendations was easily tracked and assessed using good measurements. High-level, overall lean metrics were helpful to event participants when they understood the link between the specific event process and its relevance to overarching organizational goals.

b. Issues

When metrics were not put in place, or not captured, the improvements realized by lean events often decreased over time, resulting in a falling back to pre-lean process activities. It was difficult to design metrics that were quickly and easily tracked and did not generate an unnecessary amount of work to collect. Measurements that contributed to management decision making and higher headquarters reporting were not successfully captured.

6. Vision, Urgency, and Goals

a. Benefits

Lean participants that had a good understanding of the vision, urgency, and goals of lean were well equipped to tackle process improvement with an eye on the overall objective. These people understood what they were doing and why they were doing it. Lean events that they contributed to were frequently successful. Consistent management articulation of vision, energy, and goals facilitated the energy and enthusiasm required for successful implementation by those involved. The commander assisted greatly in this communication by addressing lean participants explaining his vision, the urgency for process improvement, and overall goals of lean at White Sands.

b. Issues

Many leaders did not consistently articulate the vision, urgency, or goals for lean. The workforce observed no uniform message, resulting in a mixed impression of the importance and necessity for lean. Managers' actions sometimes communicated differing perceptions of urgency than the commander's, which sent a mixed message to the workforce.

7. Uniquely Governmental Issues

a. Benefits

There is potential for benefit when process improvements result in savings that can be reinvested by an organization. Utilization of freed up personnel and capacity could supplement processes that are in need of additional resources. Cost savings shared by those involved in achieving that savings, in the form of cash incentives, would be an effective motivational tool.

b. Issues

White Sands had little opportunity to reinvest savings gained from lean improvements. There was obvious concern with respect to the institutional/reimbursable budget construct under which White Sands operates, and how higher headquarters perceptions of lean savings might impact future funding. Savings realized by process improvement were often consumed by pre-planned budget cuts by headquarters, eliminating the possibility of any reinvestment. Personnel involved in process improvement were not able to share in, or directly benefit from, the cost savings.

Personnel moves from a saving to a gaining process were not achieved, as the personnel system does not facilitate that kind of action, particularly when individuals or managers resist. Several references to individual resistance illustrate that there will always be those in an organization who will defy any change for one reason or another. It could be helpful for managers implementing lean to be able to quickly deal with someone like this in order to eliminate them from the process and minimize the impact of their resistance.

8. The Lean Process Itself

a. Benefits

When lean events were preceded by comprehensive preparation by the facilitator and team and the improvement process was followed throughout the course of the event, the results were consistently positive. Lean tools and event process were effective in guiding the team to the best understanding of the problems and the optimum solutions for process improvement.

The lean consultant was effective in guiding senior managers, the lean team, and specific lean events, when they understood White Sands' business and the process in question, applied the lean methodology appropriately, and facilitated a team's activity through the improvement process. They were an invaluable asset in this capacity, as White Sands personnel were not well equipped to launch lean activity on their own.

b. Issues

There were many instances where a portion of an event team spent a great amount of time in preparation and came into an event with informed ideas on potential solutions. As those solutions were advocated, the less prepared on the team interpreted this as personal agendas and predetermined solutions or outcomes. There were also instances where an influential individual would assert his or her personal opinion and preferred solution on an event team.

The lean consultant often did not understand the process being addressed and was not physically available on site enough to be "educated" regarding White Sands' business processes. As a result, there were instances where manufacturing tenets of lean were forced onto an administrative process or where lean tools were otherwise applied inappropriately to processes.

V. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

“It [lean] has promise, as a tool, and we should be using it. I fully support it.” “It will definitely help us transform the Range. It’s the best thing we’ve got going. If it ain’t broke don’t fix it, doesn’t hold anymore in the current Army strategic position. If it ain’t broke, how can we make it better?” “We’re better off than most of the Army because we have done lean already. It’s very necessary.” “There was universal agreement that we should continue lean at White Sands even if it were not being mandated by the Army.” These quotes, directly from our survey and interview responses, capture what we feel is the real bottom line message of our research – that notwithstanding the difficult issues we have examined in this study, we find overwhelmingly that there was broad incremental benefit from lean; that its cost was warranted and necessary; that it absolutely should continue to be used as a tool to achieve greater efficiency, quality, and effectiveness in government business processes; and that there was definite positive moderation on the issues we have presented in direct proportion to time and engagement in lean activities.

In answer to our primary research question: How can a Government organization with primarily administrative processes overcome the significant issues and challenges associated with implementing LEAN thinking? - we offer the following conclusions and recommendations. We view them as possible aids to lean implementation for other government organizations similar in structure and mission to White Sands, and as a means to get ahead of the two-year learning curve that has brought us to these realizations. We offer them as neutral academic correlations of observations with the intent of promoting and advancing the success of Army process improvement efforts and maximizing their potential for broad and continuing benefit.

B. CONCLUSIONS AND RECOMMENDATIONS

1. Linkage between Lean and Personnel Cuts

a. Conclusions

It is clear that any stated or perceived linkage between a lean effort or process and the idea of personnel cuts, reductions, or other adverse actions will have a significant negative impact on its success. Early on in our data collection, and persisting throughout the collection process, we found recurring and substantial negative consequences from such linkages. This was largely a matter of perception rather than actual intent, but the effect and impact were the same.

b. Recommendations

Process improvement efforts should not be tied, either perceptually or procedurally, to workforce reductions or other adverse actions. Our study shows overwhelmingly that management and the workforce will resist lean efforts that appear to focus on such reductions or actions. Process improvement efforts may very well prescribe reduced amounts of human effort, but these saving must be characterized as being prime for investment in other areas, perhaps back into the lean process itself, or in terms of potentially positive actions. This constructive connection to reinvestment must be succinctly and clearly formulated and universally communicated.

2. Management Support of Lean

a. Conclusions

Highest level management, change agents, and a majority of working-level lean implementers understood the objectives, potential, and direction of lean activity, and knew what needed to be done. However, a lack of focused and consistent support was observed among the mid-level management. Although this would not represent a majority in terms of numbers of individuals, it had a significant effect in terms of the influence and visibility of leaders among these ranks. There was an obvious inconsistency in the perceptions of leaders at this level, and lack of a continuous thread of

clear communication from the change agent level, through the management chain, down to the working level and the forum of the lean implementer. These issues moderated in proportion to level of participation, leading to increasing management support over time.

b. Recommendations

It is imperative for the leadership to establish, agree upon, document, and then objectively manage and propagate a uniform set of policies with regard to lean activity. These policies must be vigorously and visibly supported via a unified management front that includes:

- Positive actions, words, and resourcing regarding lean activity.
- Frequent and in-depth participation in actual lean events.
- Inclusion of lean objectives in performance standards.
- Decisive corrective measures when policies are not fully supported.

3. Small Incremental Benefits versus Large Bottom-line Impact

a. Conclusions

The most realizable and sustainable benefits from lean implementation will result from accrual of smaller incremental improvements that may only become evident over a substantial amount of time. Although large benefit was often called for or anticipated, we did not observe any large-scale savings or impact on the “bottom-line,” at least during the relatively short time period spanned by our data. We found that almost all lean events were judged to have produced some level of incremental benefit. This benefit may have been small and difficult to quantify, but was consistent across the board and represented the norm for a large government bureaucracy in the initial stages of lean implementation.

b. Recommendations

Couch expectations and projections based upon the collective benefit that can be amassed from many small, focused, and continuing improvements, throughout the value stream. Seek to establish and foster a culture of continuous improvement and plan to vigorously measure small savings, expecting benefit to compound steadily over a long period of time, rather than be immediately achieved or measured in large “chunks.”

4. Process Documentation

a. Conclusions

Most processes in a large government bureaucracy are not documented, often being vested in the experience or “corporate knowledge” of a few individuals. Many lean events turned into process documentation efforts. While this was universally viewed as a benefit of the lean process, it is not the primary objective of process improvement. Time required to document existing processes precluded a focus on actual process improvement. In order to gain the greatest benefit, value, and potential for savings from lean, it must be employed on a well-defined and documented process.

b. Recommendations

Existing critical processes recommended for improvement via lean, must be well defined and carefully documented prior to the initiation of lean activity. Lean tools are often quite useful in analyzing and documenting processes, but such activity must be engaged independent of process improvement events. Specific training in systems engineering or related fields of study may be required to train government employees in process analysis, orientation, and documentation, outside of a lean effort itself.

5. Metrics and Measurement

a. Conclusions

There was nearly unanimous agreement that smaller incremental benefits were realized as the result of most lean events. It was also universally agreed that there was no way to quantify the collective value of these gains. Everyone understood and appreciated the need for good measurements, but all were hard-pressed to deliver meaningful measures of the benefits that were being universally described. Many potential benefits were lost as processes “fell back” to pre-lean norms, in the absence of good metrics.

b. Recommendations

Prior to the conclusion of a process improvement effort, precise measures of specific parameters (e.g. cost, schedule, performance) that confirm initial and ongoing improvement must be established. Mechanisms for the collection, archiving, and analysis of this information, its use in management decision making and its reporting to higher headquarters must also be put in place. Plans for sustainment of metrics collection and analysis must be established such that latent accrual of small benefit can be captured and quantified over long periods of time (years). Metrics schemes must be carefully designed such that they do not create more work than might be saved from the improvements they are attempting to measure. Specific training in program management or related fields of study may be required to train government employees in process metrics, analysis, and reporting, separate from the process improvement effort.

6. Vision, Urgency, and Goals

a. Conclusions

Particularly in the mid-level management ranks, there was marked variation in interpretations of what the vision for lean was at White Sands, what the real urgency behind that vision was, and what stated goals and expectations were supposed to have been derived from that vision and urgency. Although most employees had ideas

about these concepts, it was clear that a uniform understanding of lean, its application at White Sands, the responsibilities of individuals, and the benefits that should be expected was never fully established. That single homogeneous thread of communication from the change agents, through the management ranks, to the working level was never fully realized. So individuals were left to interpret and synthesize often out-of-context information for themselves. If leaders, managers, and the work force are not in full agreement, squarely behind, and constantly advocating for process improvements, embodied in a common set of lean goals and objectives, visible and measurable success will be very hard to achieve.

b. Recommendations

Establish and propagate a vision, an urgency to realize that vision, and a commonly accepted and fostered set of goals relating to lean. This is principally a matter of assuring understanding and agreement at the highest level, and ensuring detailed and continuous communication of that understanding throughout the organization. This formulation of high-level policy and propagation throughout the workforce must occur well before lean activities are initiated - otherwise people will begin to draw uninformed conclusions about such activity. Positive messages about goals and expectations must be continuously over-communicated to the workforce to reinforce the vision and urgency of implementation. Managers in particular, must realize that their level of support will be measured in terms of their own involvement, actions, willingness to dedicate resources, and personal assessments or opinions about lean efforts. These “support indicators” will be very visible to the workforce and will have a profound effect on their motivation and sense of worth and ownership with respect to process improvement.

7. Uniquely Governmental Issues

a. Conclusions

As we had theorized in Chapter I, the Government bureaucracy at White Sands acted and reacted generally like any large corporate entity would be expected to.

With respect to backsliding to old ways, lack of implementation know-how, sense of urgency, inability to account for “shop-floor” gains, middle management resistance, lean viewed as the “flavor of the week,” and other indicators, White Sands looked just like the rest of corporate America (Marchwinski, 2006).

There are some uniquely governmental factors, however, that deserve special consideration by organizations in the public sector that are considering lean implementations. First, the government generally cannot “bank” savings and reinvest saved dollars with full discretion. Government fiscal accounting procedures and practices do not currently include straightforward methods for monetary reinvestment. This reduces the incentive to save, as it is not necessarily clear how this can consequently benefit the “saving” organization.

Second, an MRTFB like White Sands actually has two budgets, one funded by the institutional Army and another funded by reimbursable charges to range customers. A cost saving in one of these budgets may actually result in a cost “shift,” from one budget to the other. This can have the dual effect of looking like a welcomed savings to one side, and an unwelcome burden to the other, unless measures are taken to increase customer throughput to cover remaining costs, and assurance is made that total operating cost is truly permanently reduced. A similar situation could occur with savings on the institutional side, with similar measures being required to ensure that they are not just a shift of costs to the customer.

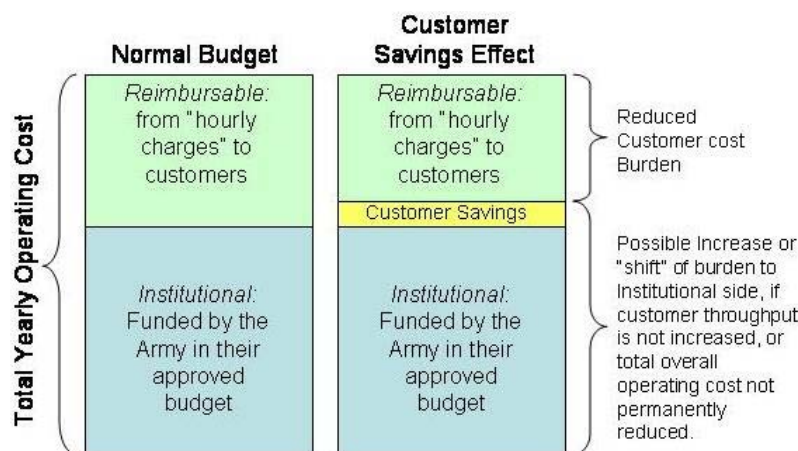


Figure 5 – Potential Lean Impact on WSMR Budget

Finally, a government agency does not have much latitude with respect to personnel. Being able to initiate personnel actions quickly and easily is just not supported in the government bureaucracy. The ability to “reinvest people” is limited and even resisted by management; if elimination of functions or slots is indicated, government organizations have few positive options to choose from in dealing with those positions. If progress in process improvement is being obviously impeded by “anchor draggers” that are unable or unwilling to change, the government has few alternatives for dealing with their removal.

b. Recommendations

The inability to bank and reinvest dollars needs to be well understood and appreciated by government lean implementers. It must be made clear that increases in efficiency, true cost savings, and elimination of waste, will ultimately benefit the Army and the Nation as whole, and this fact should not be seen as a disincentive to save, despite the probable lack of a directly tangible benefit to the saver. The Army would certainly see greater focus, and increased probability of large savings and benefit, if mechanisms could be established that allow for direct reinvestment of savings that might lower impending institutional budget requests. An ability to substantially reward lean implementers that can demonstrate measurable and continuing improvement would also substantially increase the probability of successful lean implementation.

An MRTFB must ensure that savings on the institutional side of the budget are offset by commensurate increases in functional throughput so as not to appear as a “gap” in the reimbursable budget that becomes a burden on the customer. Similar increases in operational throughput must accompany a savings on the reimbursable side, so as not to appear as an increase in institutional requirement.

If process improvements have the potential to involve personnel actions, the government agency must first develop an action plan for dealing with those actions, before individuals are affected. Such an action plan must strive to employ positive measures, particularly if reductions are possible. For example, we view voluntary early

retirement and retirement incentives as positive ways of dealing with personnel reduction. However such measures must be employed with individuals who openly desire retirement, rather than those who may simply “be eligible” by service computation date, and be directed to retire as the result of a lean event. Part of the action plan must include a plan to swiftly deal with individuals who are obviously impeding the progress of lean improvements.

8. The Lean Process Itself

a. Conclusions

There was a common perception that lean events were scripted or directed to arrive at some predetermined outcome. Indeed, many at the working level sometimes felt like they were just going through the motions to legitimize some predefined solution or objective. We discovered that there was wide variation in the amount of preparation that lean facilitators and team members engaged in. Some did very little preparation and let the lean process “flow naturally.” Others gathered large amounts of data and explored many possible solution spaces. When these better prepared facilitators came to lean events with in-depth understanding of possible solutions that may very well have appeared like predetermined outcomes.

There was a universal perception that the lean contract consultant, while highly qualified, was poorly suited to assist White Sands with lean implementation. They were seen ultimately as not understanding the Test and Evaluation business, and the unique, non-manufacturing-oriented details of White Sands operations. It was perceived that they had a hard time adapting the manufacturing-based concepts of lean to the largely administrative process employed at White Sands. It was observed that we also did not do as good a job of educating the consultant in these areas as we could have. The consultant was seen as not having been available enough to support the required frequency of lean events that would ensure success.

b. Recommendations

Any perception of, or actual, predetermination or steering of lean events must be avoided. Early explanation of the nature of event preparation and direct involvement of all expected event team members is essential to preventing misinterpretation of good preparation for predetermination. Detailed and comprehensive preparation is essential, but lean events must be allowed to “flow naturally,” using prepared materials and lean tools as they are intended.

An objective, outside lean implementation expert must be employed. Great care must be taken in selecting a consultant that understands completely, or has the time and inclination to become well informed on, the organizations core business processes. This consultant must be available, on site, suited to the organizations long-term needs, and able to support the frequency, depth, and magnitude of process improvement activities that will ensure success. If the consultant is acquired through a contract, then an appropriate contract must be executed that supports these recommendations.

C. RECOMMENDATIONS FOR FURTHER STUDY

The volume of data and complexity of analysis grew quickly during this project, and several compelling issues that exceeded the scope and schedule of our case study were identified. We believe these issues are equally significant in terms of their probable impact on current and future government process improvement efforts, and warrant further study and investigation.

1. Cost of Lean and Return on Investment

There was an obvious lean implementation cost at White Sands, but the nature and magnitude of that cost was not well captured, and were widely interpreted and variously perceived. Because the small incremental benefits that were realized were not well measured, true cost benefit ratios could not be derived. More in depth study of the

costs associated with lean implementation and quantification of actual savings could shed light on the real return on investment that is being realized through these kinds of efforts.

2. Training Issues

Our data pointed to the desire and need for more training. We perceived this desire to be for training in lean concepts tools and implementation methods, but also identified a significant need for training in areas not necessarily directly related to lean. These areas included systems engineering, program management, management by metrics, and process documentation. We believe that the success of lean or any other process improvement regimen will depend greatly on the development of the government workforce's general expertise in these areas. Further study is warranted into this arena, modeled upon the success the government has achieved with mandatory training programs associated with ethics, sexual harassment, drug and alcohol awareness, safety, security and antiterrorism, and other similar areas where the government has significantly raised awareness and competence among its employees at large.

3. Lean Team Documents and Materials In-depth

We could not examine the massive body of information actually collected and documented by the dedicated lean team at White Sands during the course of their implementation events. We relied on the testimony of individuals who had knowledge of that information, to gain some insight into its significance. Actual in-depth examination of that detailed information and how it compares to the anecdotal knowledge that we have collected and analyzed in this study could yield valuable findings, particularly if that information were brought together and correlated.

We touched on an example of such a correlation in developing an email distribution list for the execution of our survey. When we asked the White Sands lean office for a comprehensive list of lean event participants, they indicated that they did not have an overall list. We also had asked for a list of individuals who had participated in more than one event, and how many they may have supported. This information was also

not available. Individual lists of participants were a standard part of each event's archived information, however. We went to the lean archive and pulled out the individual lists copying them into a single master file. Immediately we noticed that there were several duplicate entries, representing those persons who had supported more than one event. The number of times their names appeared told us how many events they had participated in. We believe a wealth of information like this could be uncovered through further in-depth study.

4. Significance to Current Army Lean Six-Sigma Effort

Although we have concentrated on studying a pure lean implementation at White Sands, we believe the issues we have observed have less to do with lean and more to do with how the government generally does business. For this reason we believe that the conclusions and recommendations we have proposed will be significant and applicable to any process improvement effort the government may pursue, particularly the lean six sigma effort that is currently being rolled out in the Army. We believe more careful study of this correlation is warranted.

5. Customer Focus Issues

We observed a marked absence of customer focus among participants in our interviews and surveys. We were surprised and concerned by this, but found it to be outside of our scope to examine it in detail. More investigation into this observation could yield valuable insight into how government process improvement efforts are viewed by our customers, and what impact they might feel as a result of those efforts.

6. Time as a Primary Commodity of Value

Although there was great focus in our study on efficiency and dollar cost savings as measures of lean benefit and effectiveness, we observed that time was the number one commodity of value among the individuals we surveyed and interviewed. Time was the element most difficult to invest, on behalf of expert and capable implementers, and time

saved was the most sought after return expectation from lean process improvement events. We believe some study of what the most effective measure of lean success and effectiveness is, dollars versus time versus some other commodity, is certainly warranted.

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APPENDIX A – ACRONYM LIST

AMC – Army Material Command

ARDEC – Armament Research Development and Engineering Center

ARL – Army Research Laboratory

CCM – Center for Counter Measures

DoD – Department of Defense

DTRA – Defense Threat Reduction Agency

FCS – Future Combat Systems

GM – General Motors

GWOT – Global War on Terrorism

HELSTF – High Energy Laser Test Facility

IDAP – Instrumentation Development and Acquisition Program

IG – Inspector General

JIT – Just In Time

Kaikaku – Japanese word for “radical improvement”

LSS – Lean Six-Sigma

MUDA – Japanese word for “waste”

MRTFB – Major Range and Test Facility Base

M&S – Modeling and Simulation

NASA – National Aeronautics and Space Administration

NCI – A White Sands technical contractor.

NDAA – National Defense Authorization Act

NPS – Naval Postgraduate School

NPS IRB Committee – Naval Postgraduate School Institutional Review Board

PAX-2a – Picatinny Arsenal explosive 2a.

PDC – Professional Development Center

RIEs – Rapid Improvement Events

ROI – Return on Investment

SES – Senior Executive Service

SOFIMS – SOMARDS Financial Information Management System

SOMARDS – Standard Operations and Maintenance, Army Research and Development System

SoS – System of Systems

SME – Subject Matter Expert

TAQ – Total Army Quality

THAAD – Theater High Altitude Area Defense

TQM – Total Quality Management

TRADOC – Training and Doctrine Command

T&E – Test & Evaluation

USASAC – United States Army Security Assistance Command

VERA/VSIP – Voluntary Early Retirement / Voluntary Separation Incentive Program

VSA – Value Stream Analysis

WISMIS – White Sands Information System Management Information System

WSMR – White Sands Missile Range

WSTC – White Sands Test Center

APPENDIX B - DATA

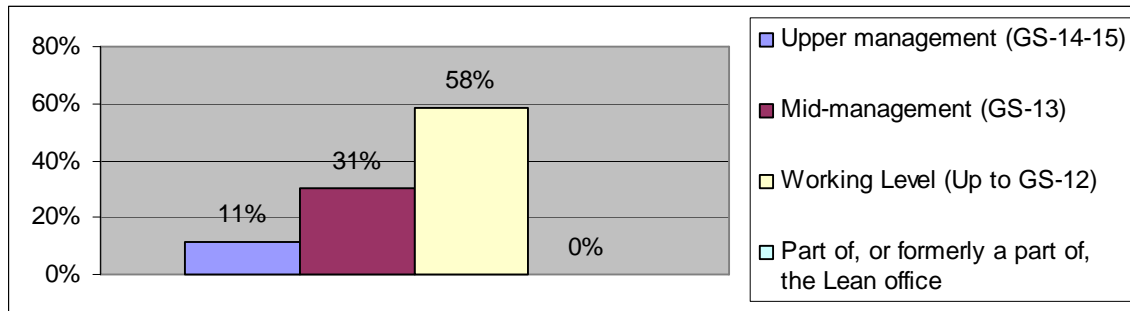


Figure 6 – Survey Question 1

The majority of the survey participants were Government employees, GS-12 and below. They represent the journeyman/working level workforce at White Sands. This is the group that we most wanted to reach with this survey, given that our data set already included a number of interviews with division/branch level managers and higher-level leaders.

While no one indicated that they were a member of the lean office, involvement described in follow-on questions indicates that there were some in this category. This question was poorly formatted as a multiple-response question and resulted in individuals reporting their grade and moving on to the next question. Survey guidelines suggest against this kind of question format. None of the remaining questions were formatted in this way.

1. Was There a Compelling Reason to Use Lean at White Sands?

Budget cuts, personnel cuts, increasing workload, need for efficiency, and elimination waste. One issue was that processes were not documented. We could get an immediate gain in this respect. “Lean is one leg of a three-legged stool. Lean – Efficiency, Six-sigma – Quality, Schedule - Theory of constraints,”

Participants gave a range of responses emphasizing the need to gain efficiency and eliminate waste in the face of The Army’s Transformation mandate, declining budgets and ever increasing resource constraints. A changing White Sands mission, new

requirements brought on by changes in the DoD material acquisition process, and the T&E requirements of new system like FCS where mentioned. It was pointed out that “there is always a compelling reason to look for efficiency,” and that lean was a tool that already existed or was already “out there” for this purpose. From the military perspective the mandate or reason was clear, “The Chief of Staff of the Army said so, we don’t have a choice, – we have to use lean.”

It was our budget crunch. Every year we had budget drills and this was our chance to be proactive versus just responding every year to what they sent down. It was driven by efficiency, the need to identify wasted effort, and a desire to make White Sands more efficient, to look at what you are doing to see if you can do better, to “shake up” the way we do business.

It was the commander’s baby. It was being thrown around the Army and he saw it coming.

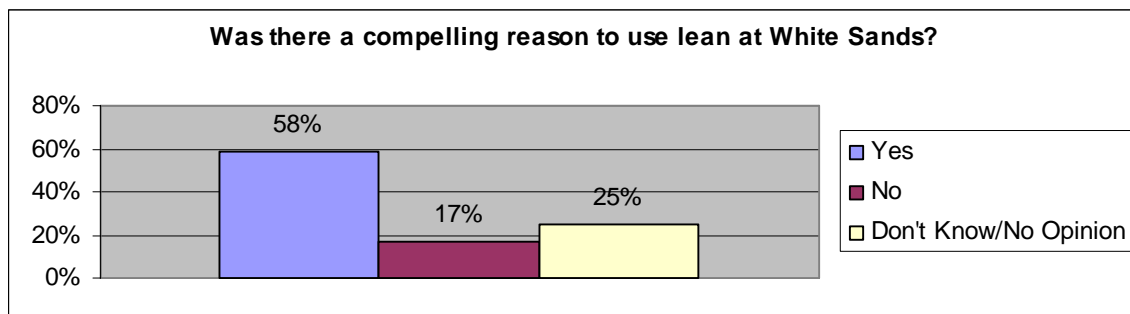


Figure 7 – Survey Question 2

A majority of participants indicated a compelling need for lean and included such reasons as identifying waste and inefficiency, determining most efficient methods and practices, process improvement, freeing up resources, saving money, and changing the culture to one of constant improvement.

2. Was There a Vision for Lean at White Sands?

It was under the former commander. His goal was to change the culture.

The vision for lean was to make it a part of the culture and provide managers, supervisors, everybody, with tools they need to look at their process and their work to

find efficiencies and improve the product they are providing to our customers. But there was a problem tying this to VERA/VSIP and personnel or workforce reductions. From the outside eyes perspective, the view was that there must have been, although it was not quite clear. Also from this perspective, the effectiveness of lean in a manufacturing environment had been witnessed but it was stated that “it will not be easy” to bring this concept to an administrative or office environment.

To transform the entire workforce and implement lean in all work processes - but we didn’t sit down and write that out formally. It came in through the commander – he saw reduced cost and time elements. He saw it as a tool for identifying waste, although he was not sure he could communicate that. He foresaw that the Army was going to do lean and wanted to get “a jump.”

The main vision was change. The commander saw the need to do things differently because of technology. No more manual processes, we needed to change.

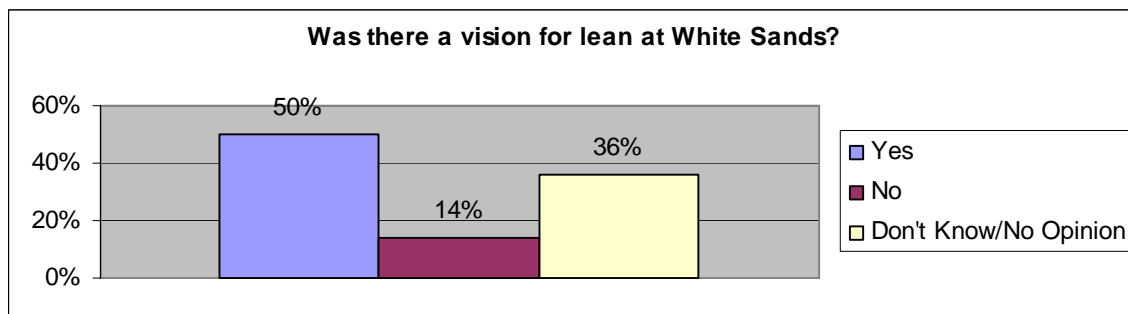


Figure 8 – Survey Question 3

Again in this question, most responses spoke to a vision of improving processes to find increased efficiency. A contrasting opinion was that the vision was to “reduce the workforce.”

3. Was There Urgency to Implement?

It goes back to the compelling reason. Look at what the Army has to do with the GWOT. We can’t afford to sustain the troops and fund something like FCS. It’s critical to Army transformation.

There was urgency. Knowing that budgets were going to be so tight. The uncertainty of NDAA created urgency to find “any ways” to reduce time, people, or money required to “do those good products.” Part of the problem was tying that urgency to “letting people go” to meet VERA/VSIP goals. It was not as well thought out as needed, and focused on where “there are too many people.” The outside eyes “suspect that there was,” and pointing out that White Sands did lean before the Secretary of the Army mandate.

It was budget, and the commander knew he only had one more year – one year to get something implemented. He had an internal urgency. By design lean is meant to operate in urgent situations. The commander used his leadership to instill a sense of urgency. The impending budget cut of \$47M gives current urgency.

Oh yeah, definitely. I got the word and within a month I was in training and the lean office was rolling. It was urgent because of the commander pushing, wanting it done as soon as possible. The commander was very active.

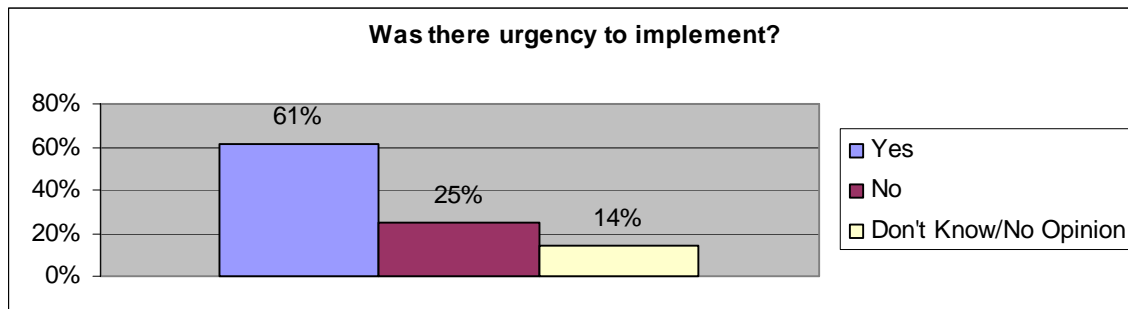


Figure 9 – Survey Question 4

Most participants said there was an urgency to implement lean at White Sands. When asked to describe it the common response was the need to fix outdated and inefficient processes. Several responses indicated the existence of urgency was evident because of the commander’s emphasis, and the resources being expended to implement and staff lean. An interesting response was that the “workforce had no opportunities to improve any process until lean was implemented.”

4. Were There Stated Goals?

There were stated goals. I can't tell you exactly what they were, but it was something like 10% efficiency gain and 10% cost reduction. We needed to reduce our institutional burden and address the issue with the reimbursable budget. What do you do with the savings? You can't "bank it." It's an end of year thing. Even if you save 10% in people, what do you do with them?

Yes, the key was looking at process and how to "transform," to look at customer satisfaction, with the overarching goal of making lean part of the culture. I don't know if there were "quantifiable" goals, other than making organizations more efficient and reducing overall operating costs. There were no consistent goals "across the board." The outside view continued to be unsure, "suspecting that there were, though."

The stated goal came from the initial VSA. I was to increase productivity by 35%. This wasn't written down, and wasn't quantified prior to the VSA. We all knew we wanted to improve efficiency and this was tied to budget. I don't think anything was defined, or if it was, it was not stated well. Just improved efficiency – I never saw anything else. They were very intangible at the start. Some change was expected in quality, schedule, and cost savings, with the magnitude being up to us.

They were focused on the customer, the number of reimbursables, our mission changing from missiles to small mission combat like FCS - how to do things smarter to accommodate new urban warfare.

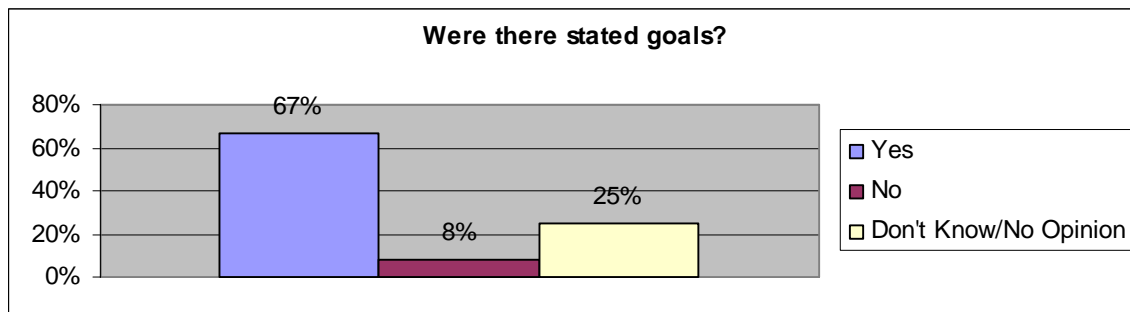


Figure 10 – Survey Question 5

When asked what the stated goals were, most participants described identifying waste, reducing costs, increasing efficiency, eliminating duplication of effort, ensuring

added value, and capturing more customer money. A couple of responses correctly stated that fewer people was not a goal of lean, however, there were also a couple that indicated that reducing the workforce was a goal.

5. Was Benefit Anticipated?

Primary anticipated benefit was reduction in institutional cost. Our higher command anticipated this by cutting our budget first. We need to work from the bottom up to achieve efficiency – “I know my job.” Lean is a tool, but we’re not motivating people to use it. We’re using a stick instead of a carrot.

“Certainly there was.” We would find areas that don’t have a defined process, and define one. Where we had one, we would improve it. All the literature said there was a cost but that the ROI would be greater. My expectation at the time was that the Directorates would be in charge, not just be told what to look at by the commander. My predecessor didn’t say much; don’t know whether he was a believer.

Absolutely. We saw that there were incredible inefficiencies at WSMR. We were hoping for huge benefit based on those inefficiencies, maybe twice the benefit you might expect in industry. Some implementers developed expectations after they got involved. I saw lean as a follow-on to the Army’s previous process improvement efforts – TQM, TAQ, whatever – lean was just another attempt. If it could be properly executed, it could be useful. Each event has stretch goals, realistic or not. I expected a lot of change and have seen some, but not as much as expected. “I wanted a Cadillac, and wound up with a Ford, but I still have a car, so that’s OK.”

The lean consultant painted a pretty picture about saving all this money. The training made sense and I gave it the benefit of the doubt. After a while the big promises weren’t there no more. I didn’t trust the contractor – their support started with the president, went down to a vice-president, and finally the El Paso rep.

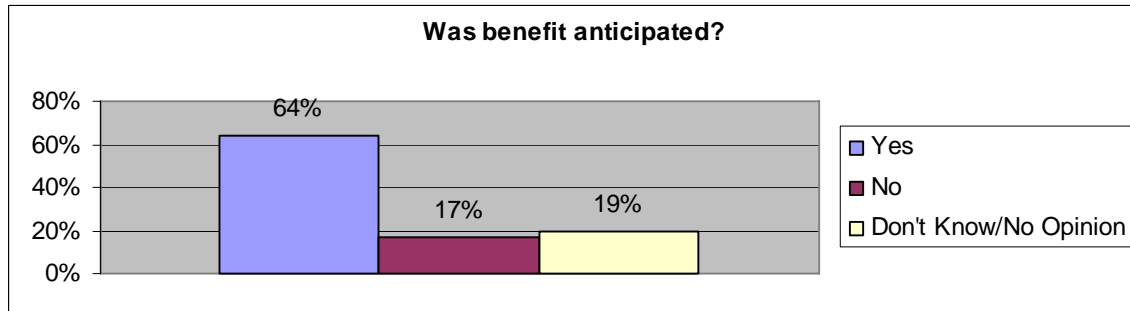


Figure 11 – Survey Question 6

Most participants anticipated benefits from lean. These expectations included: understanding and improving the processes and communication among the workforce, increased productivity, involving personnel at the working level to improve processes and reduce waste, and saving labor dollars. One comment mentioned that a lean event with a pre-conceived result had a negative impact and lowered the expectations of participants.

6. Was Lean Generally Supported at White Sands?

There was lukewarm at first, and that continues that way today. People didn't like the commander telling them exactly what to do. This was interpreted as saying which way to go, creating a lot of resent. I didn't want to continue that and backed off, maybe too much.

No, I think it was from command down to Directorate level. At Directorate got some pushback, that it was a "fad," compared to TQM, value engineering and the like. There was a "wait and see" attitude. With any new program there is always hesitation, especially "if it is being sold as a silver bullet," but, "anything that caused you to stop and look at what you are doing to make it better," is worth the effort. Upper management supported it, but less at lower levels because it was projected as a "way to get rid of your job." The outside eyes saw support in having stood up an entire office directly under the commander, indicative of the climate. That perspective was tempered by the fact that higher headquarters wants a lot of lean projects and savings at the same time that they are "cutting our funding and cutting our people," and the hope that this would not "compound the cuts."

All the literature I saw said that you can't do it without the top person. The lean team was supportive, but I don't think it was generally supported in the workforce. It was another TQM or, "flavor of the week." Senior level management didn't support it as they should have. Some people wanted it and worked to bring it about. Others supported it but "their heart was not in it." Some said it was a waste of time and asked, "Why are we doing it?" It was supported by the commander and upper management, and the workforce followed his leadership.

By the commander, yes. The rest was because he directed it. The commander was at all of the out-briefs with his whole entourage, maybe not by choice. Down below there were a bunch of maybe believers. But it has to be top down.

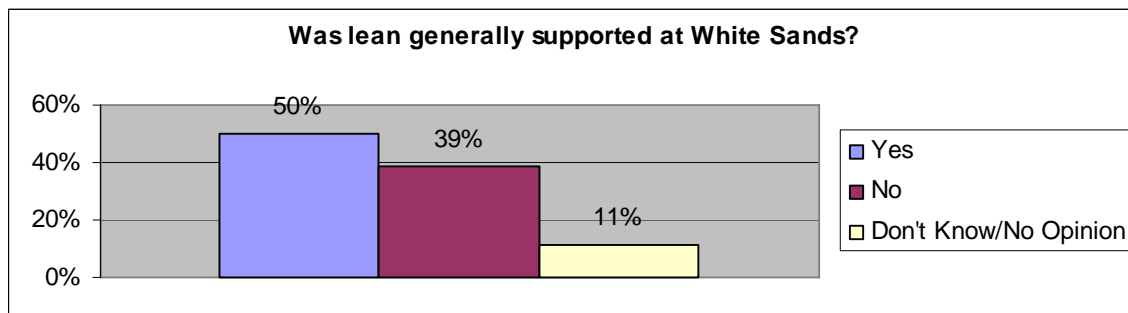


Figure 12 – Survey Question 7

Support of lean was not as clear with half of participants indicating that it either was not supported or they did not know. When asked at what levels lean was supported a common response was that at the command level it was supported with some indicating it was evident by the commander's personal involvement. There are two contrasting themes concerning management support in the responses. The first idea is that the management of White Sands supported lean, but that the working level people did not and even actively resisted.

"...The working levels, especially field personnel, who having been doing the job for a long time are usually resistant to change."

"It seemed to be supported fairly strongly at the upper levels, with a drop to grudging support to outright antagonism at the lowest levels where people felt an outright threat to their jobs."

The contrary theme was that workers who got involved supported lean but that managers did not.

“Yes by grass-roots level personnel (the worker bees) -- the folks that had a vested interest in improving the way the work gets done. No, by the management at large. Managers stand the most to lose by a change initiative, and LSS (lean six-sigma) must be driven down from the top. We at WSMR failed to get management buy-in because managers who were briefed on RIE results in their effected areas, failed to honor the results and follow through with implementation.”

“My experience was that it was supported at the participant level; however, management support was only superficial... too many current brushfires and resistance to real change got in the way of strategically defining the problems and opportunities to improve WSTC operations.”

Finally, there were a couple of responses that support was influenced by participation, and that those who were initially resistant or ambivalent became supportive with experience and positive results.

7. Was Lean Supported by Upper Management?

Upper management was lukewarm also. We have believers and non-believers. In general they are trying, but I’m not sure they all believe.

There was lukewarm support from upper management. There’s more ownership now, and they need to foster this. The commander and technical director attended many events and out-briefs. And spoke to the workforce on several occasions. Directors began to take more things on themselves and were more proactive. There was a lot focus, and a diligent attempt to make the time for lean events. The management listened well, encouraged and appreciated team, and was supportive of team’s results. The outside view was that everyone talks about it in a positive light, but all seem to have the same concerns.

I think they went along with it, but the amount of communication that has to go along with a culture change is incredible. You can’t just do one brief and expect to

change how people have been doing things for 20 years. The commander did an incredible amount of this, but it wasn't duplicated by upper management. They supported it with people and time, but didn't "communicate it." As you moved down to mid-level, support was "as required." At least our Director was pushing, but was not exactly sure how to apply lean. You could tell the level of support by the allocation of resources. If there was some uncertainty, they could withhold support and kill an effort. There were some low expectations, a "this has never worked before attitude." They attended out-briefs, on things that were important to them. Management is now turning to the process to get things done, like the reimbursable budget.

It goes back to the commander and his staff – they were told that they would. After some events people began to change, though. People don't know what lean is. MT hates us [the lean office]. They think we cut people. They come in negative and then change after an event. We're planning seminars to educate the workforce. We lost the handle on everything we did last year

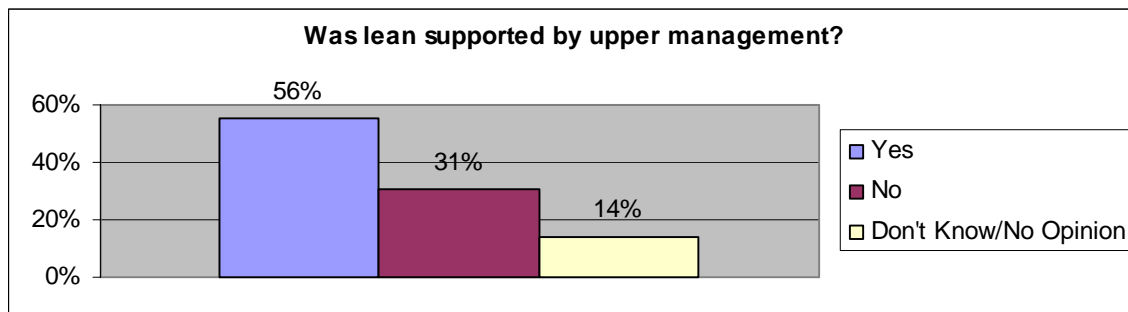


Figure 13 – Survey Question 8

As a follow up to question 7, a majority of participants said that upper management supported lean. When asked how they could tell, positive responses included: management attendance at event out briefs, implementation of recommendations, and providing support to lean activities.

Those that felt it was not supported identified things such as: lack of commitment and follow up on event recommendations, decreasing attendance at out briefings, and stated resistance to lean.

8. Was Lean Initiated Effectively?

There should have been more workforce training than we got – similar to what was given to the management team.

The kickoff and initial training were pretty good, but needed to be “pushed down” to the masses for better effectiveness. We had trouble getting people to embrace the value and effectiveness of lean. There were unreasonable expectations in RIEs, that couldn’t follow their “natural process,” with unrealistic “underlying” goals that may not have been stated outright in all cases. The message was sent out that out that we’re looking to reduce people, but should have been “I want to make your job easier. There was less emphasis on process improvement, and too much on VERA/VSIP. “They wanted key people for lean events that I couldn’t afford to let go. The initial VSA was really good, but could have been documented better and shared with workforce. The pace was too heavy at the beginning, and the follow through wasn’t there. The support contractor didn’t really understand what we do here at White Sands.

As well as you could do it. We hired a good contractor we could count on, had upper level training, established a dedicated lean team, and followed the lean consultant’s process. The number of events was good. Upper management supported with people and positions. We failed in not recognizing how to apply lean to our situation. We didn’t have enough background even though we were trying.

We started off with training, the initial VSA, and hands-on experience. It’s the same with the George Group; I have a project assigned already.

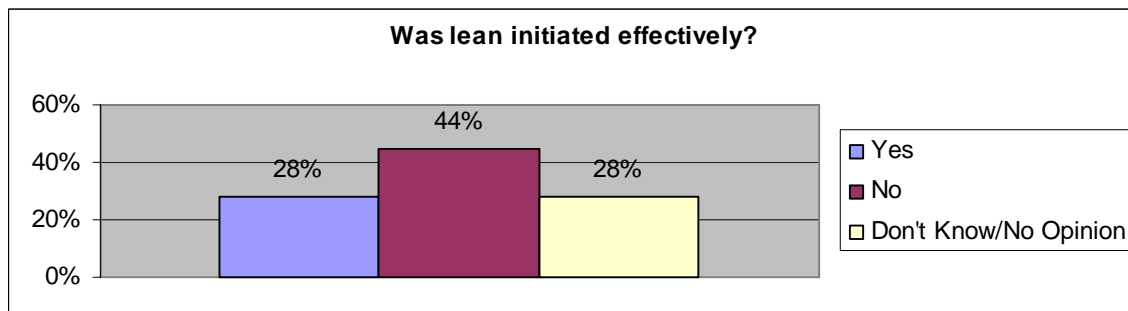


Figure 14 – Survey Question 9

Most participants responded that lean was not initiated effectively at White Sands. The support contractor was identified by several as being ineffective. Insufficient training was a problem. The most common issue stated was that there was a predetermined outcome or underlying agenda that hindered lean events.

“Some of the lean events had the appearance of predetermined outcomes, and the process was only used as a justification to implement those outcomes. The lean process determines the outcome, not the outcome using the process for justification.”

A couple spoke to the need for more lean training. The need for trained and effective lean facilitators was described. Finally, several stated an opinion that lean was used on problems that it should not have been, and that the standard lean approach does not fit in every area.

9. Were You Involved?

I initially went to every event, but thought that this did more harm than good. Maybe this was too much involvement of this type.

Yes, in the consultant selection, initial director training and initial VSA, and lots of daily and final out-briefs. “I think it would have been good to be part of an RIE.” One participant did mentioned being a team member on two RIEs.

I was in n charge of execution at White Sands and implemented lean on the Range. I was on the source selection board for contract consultant. There was a lot of discussion on whether to use lean or six-sigma. At White Sands we don’t do a lot of widgets, but we have a lot of waste, so we went with lean. I was on a couple of VSAs, and RIEs and was a SME for some events. I was involved in lots of discussions in lean events and “on the side.” I was a team member, process owner, facilitator, and administered the program.

I was an initial lean team member, and was involved in the lean consultant’s training. I participated in six RIEs, leading 5 of the 6. I was also an RIE facilitator.

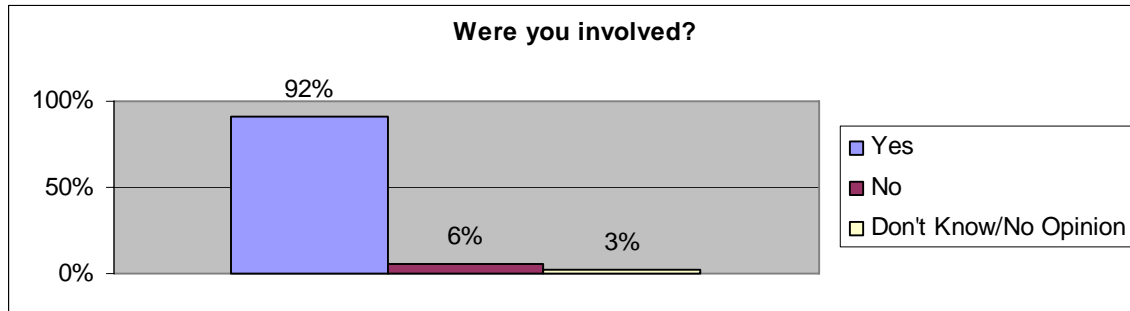


Figure 15 – Survey Question 10

Those that indicated involvement were involved as both past and present lean team members, process owners, and event participants. Their comments to the survey come as informed and experienced perspectives.

10. Were You Trained in Lean?

I have no formal training in lean.

This question was added late in the development of the interview/survey questions and was not asked of these individuals. We see from their other responses that they were involved in the initial high-level training and planning activity. Our “outside eyes” had not been formally instructed in lean, but had the chance to observe lean on the manufacturing floor through some military training.

Two participants received the initial high-level training from the lean consultant. The other had no formal training, other than that which may have come out of lean events themselves.

As mentioned in the last answer.

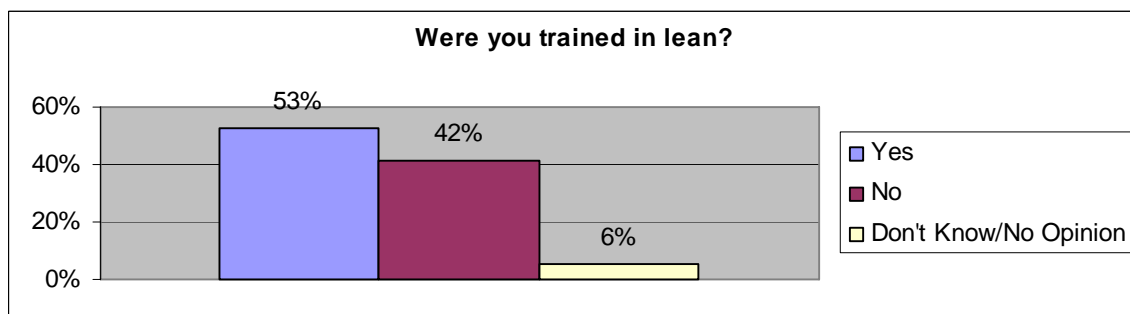


Figure 16 – Survey Question 11

Those involved in lean events only, described the first half-day presentation and the on-the-job activities of the event as training. Those involved on the lean team reported on-line training, books, and a contractor provided 2-day training event. Some indicated some self-study on lean in preparation for event involvement.

11. Was Lean Successful at White Sands?

The jury is still out, and a lot more has to be done. We were not aggressive enough and lean was not accepted enough. Now we are changing techniques, from the original lean consultant to the George Group.

Yes, we had limited success. We have not realized the full potential. The first year we were just getting an understanding and establishing communication. We were not very successful with respect to follow-up and metrics. Putting together process where there were none, was successful. I give it about a “B. It was something very much needed. For years the culture was based on a perception that we have unlimited resources. We needed a good reality check that said, “No we don’t.” The outside view was that we learned some things and that lean thinking greatly influenced the most current reorganization at White Sands.

I don’t think we got the benefits we were expecting, based on the cost, if you look at it as a cost benefit ratio. The first thing was that we didn’t define high-level metrics – what to move to. We went on with RIEs, without knowing what to shoot for. There were other benefits but they are hard to quantify. All RIEs had some level of success, but it didn’t show up on the bottom line. Lean is continuous incremental improvement. If you do this everyday things will be much improved. It was successful in producing a “change climate,” but failed to produce significant efficiency improvements. It was successful in spirit. We mapped processes, and got some communication going. The cost was \$850K + 1105 hrs at \$60/hour, outside the lean office. What have we saved? “Nary a penny.”

Yes, but not to the level I wanted. Why? Because the way it’s supposed to work is to do a VSA on a process, and then get RIEs, do-its, and projects. We didn’t do more

VSAs and then just relied on the Directors to say where the problem areas were. RIEs went for low-hanging fruit, but nothing significant.

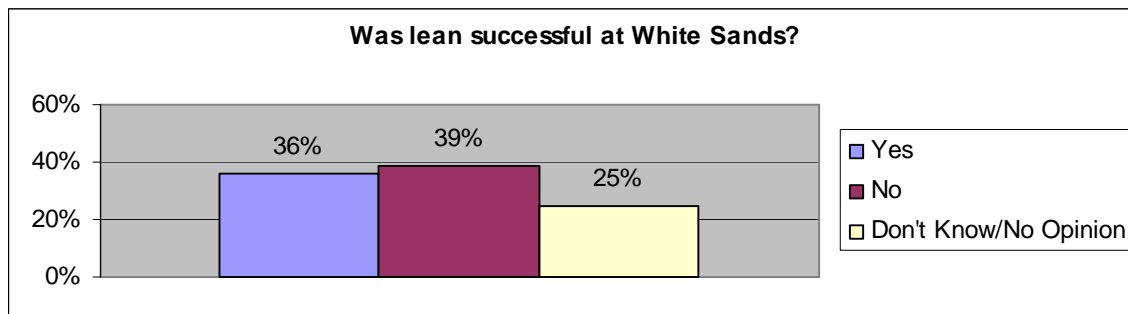


Figure 17 – Survey Question 12

The majority of participants indicated that lean was either not successful at White Sands or they did not know. When asked why, those that indicated it was not successful stated reasons including: a focus on reducing personnel, ignoring recommendations of lean events, migration back toward old ways, and using lean tools where they do not fit.

Positive comments indicate that there were numerous processes that were improved. Overall, there was an emphasis on the potential for lean success.

12. Were There Problems with Implementation?

We need to look at the whole system for weak links and address those first, not go after everything. We need to look at people, mobility of optics, evacuation areas. Where are the bottlenecks? Test is a bottleneck for the developer. For a program like THAAD it's \$1M a day for a delay. We need a systems engineering point of view and program management point of view – not isolated projects.

There were two big mistakes – failure to track clear metrics with regular reporting, and a

Top down mentality “about outcomes.” Another ever present problem was finding “that week of time,” that doesn’t conflict with the mission, and we became defocused along the way. I’m not convinced that the contractor really understood our business and what we do. They tried to approach lean at White Sands as manufacturing, but we’re just not that.

Even so, I saw proud people, excited about improvements, and proud to brief the commander. The outside perspective was “none that I know of.” There will always be somebody who doesn’t like it. Hopefully non-believers will “see the light.”

The biggest problem wasn’t with lean philosophy - it can work anywhere. It came back to leadership support, embracing lean, showing they were serious, and “feeding it down.”

Too many times the outcome was designed before the process was implemented. Lean doesn’t help much with processes that are highly variable and infrequent in occurrence. Lean assumed that there were defined processes. Lean just defined the processes – that’s process definition not lean. There were no problems beyond what would be expected in an established culture. The availability of the lean consultant was hurting the number of events. Their learning curve was so great, at first, it was slowing us down.

Process owners – they didn’t take it seriously, no one wants to do it – the charter, the data collection. At my training in Aberdeen, of 26 people only half were process owners, the rest were just people sent there at the last minute. They take over the metrics at the end – who wants that? When I came back the original lean office chief was gone. He was always push, push, push, and we were all thinking the same. Without him everybody is doing their own thing, going in without data, relying on process owners. I go in prepared with data – that’s why I’m successful. With data you can prove things and disprove things. Lean six-sigma is 90% six-sigma and 10% lean. Some tools are the same. Lean six-sigma is data, data, data, and analysis. Lean is just eliminating waste.

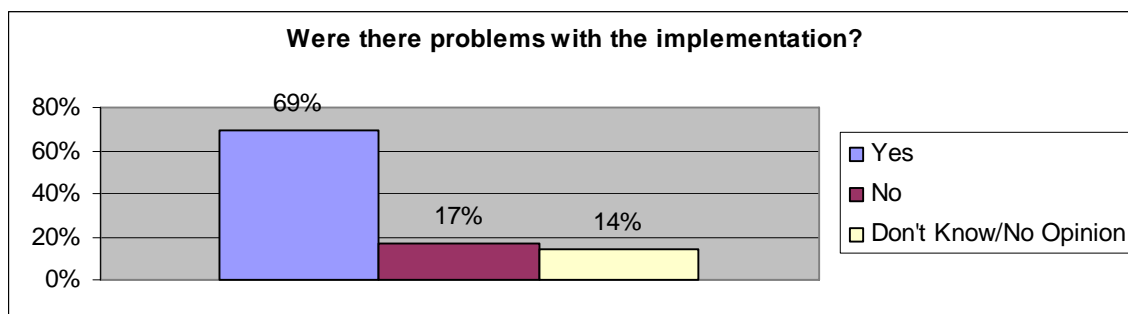


Figure 18 – Survey Question 13

The majority of the participants indicated that there were problems with the implementation of lean at White Sands. Problems identified include: management not following through with improvement recommendations, a lack of sufficient training, insufficient buy-in at all levels, and the difficulty of getting the right people to the events and having their time dedicated.

13. Did You Participate in the Initial Value Stream Analysis?

No, I did not.

All had participated in the initial VSA, except for our outside eyes.

Yes. The cost was OK, but I don't think the numbers it created helped us pick good RIEs. There weren't things the "jumped out," as they should have. It didn't work very well because it's very hard to define a value stream if you don't know where you are going.

Yes, it was the Patriot open-air range. We did a very good job from a theoretical perspective. There were issues with the scope of the problem being multi-variable and multitask. Lean tools for that large of a process were ineffective and we couldn't find a critical path.

It went well and built my foundation. It was a good start.

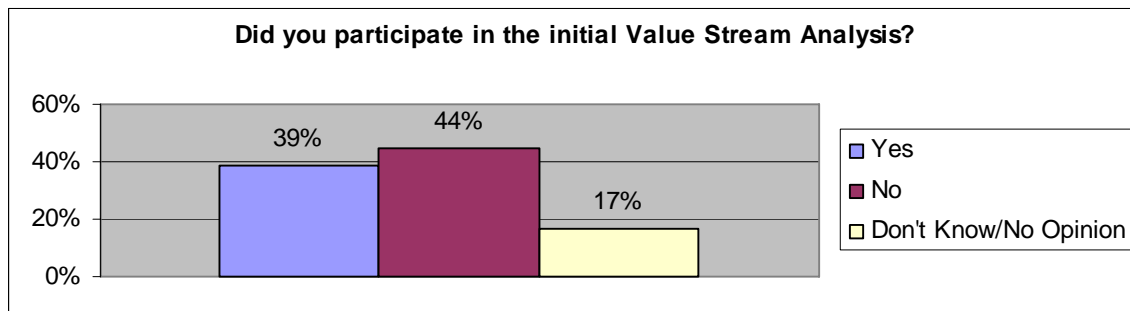


Figure 19 – Survey Question 14

Most of the participants were not involved in the initial VSA that took place as the first event of the WSMR lean implementation. This was a VSA that looked at the core test process at WSMR. Those that participated indicated that it was valuable and eye opening and helped key personnel to understand the overall process. A number

thought the question referred to the value stream mapping that happens in every lean event.

14. Were You Involved in any Rapid Improvement Events?

I attended daily out-briefs, for a period of time.

Only one participant at this level had participated in an RIE.

I was involved in planning all of the events, but didn't facilitate. I went back and forth between events as they went on, administering at the same time. I participated in two. I was also a process owner and an SME. I was a facilitator and team member. RIEs are supposed to be small events, where simple things come out.

I participated in six before I left the lean office and 3 since I returned.

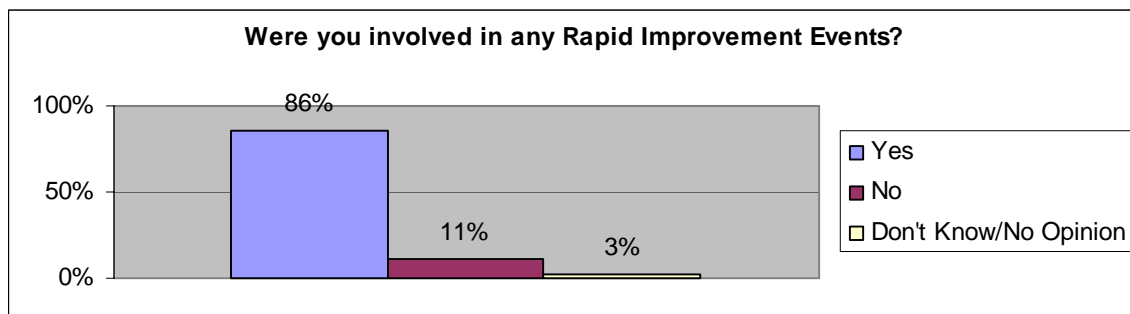


Figure 20 – Survey Question 15

Most of the participants were involved in RIEs. They participated in every role possible: process owner, facilitator, team member, subject matter expert, and outside eyes.

15. Did Outcomes Match Up with Stated Goals?

Not yet, but the potential is there. We're heading in the right direction. Can the Army achieve a 30% savings – I'm skeptical. How will we know when we've done our part? They just salami-slice out our part, and it is out of proportion.

Outcomes matched up partially. We still need metrics. We still need to look at the hard areas like telemetry, optics, and temperature test, driven by the branches and

divisions. I don't think we achieved the goals we originally set out. A few RIEs had tangible savings, but didn't identify anything significant. We did document and clarify some processes, but there was no great savings or efficiency. Maybe we couldn't get there, maybe it was unrealistic. The biggest problem was no metrics and no follow through. The outside view was that outcomes matched up with, or exceeded stated goals in the RIEs they had been out-briefed on.

Sometimes – every RIE had goals. You may not know what the goals are till you get into it. The RIE process was a little too simplistic. We need to be careful about not breaking things that are related. We almost never initiated change on day two, and were hesitant to “pull the trigger,” even at the end of an RIE. The goals not necessarily appropriate with what was possible. There was too high an expectation. The most successful one I was on was very focused, with clearly defined goals. The lean tools worked, focused on efficiency, and created a change. Many action items were never accomplished, but that doesn't mean they were “doable.” Those were supposed to go back to the Directorates and be evaluated for applicability. There was success in changing corporate culture, but the dollars haven't broken even yet. We're having a hard time measuring cost savings. We're avoiding cost avoidance as a measure of savings.

In my events, yes. I would go in with a problem statement, baseline metrics, and data. Now we go in without all of that, for only two days, and get nowhere. Before, I followed the method the way I was taught. When I came back, the emphasis was on quantity. I told the new chief I would take one per month. Others did as many as five per month. Its prep, prep, prep. They don't do as much as I do.

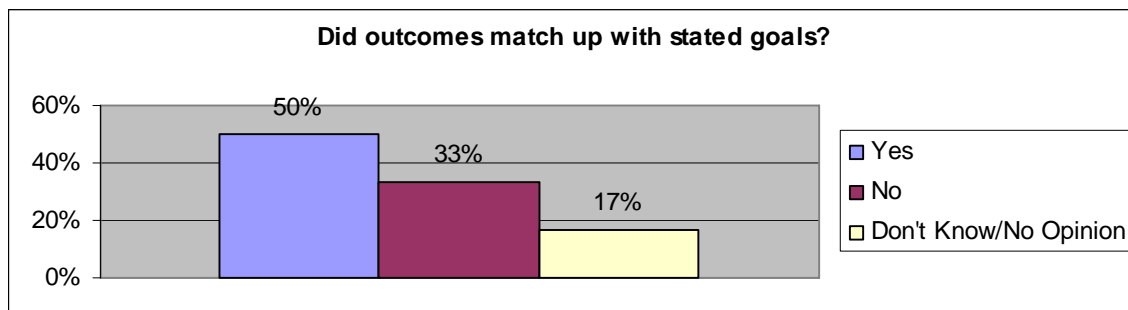


Figure 21 – Survey Question 16

Of those with an opinion, most indicated that outcomes matched goals. Comments indicated that goals were generally or mostly met. Contrary comments indicated that predetermined outcomes/goals were a problem. Several people indicated that not all recommendations were fully implemented.

16. Did the Workforce Have Impressions of Lean?

They run the full gamut. Again, they are lukewarm, with people “just waiting and seeing.”

They tended to be negative, taken as “here’s another management idea.” “It only takes one or two, especially if they are in leadership.” “I’m a little insulated up here,” but generally I think they were not convinced it was really going to work. We could have done better at picking events with immediate tangible returns – to demonstrate success to the workforce early. Everybody was committed and became more positive once they had been through it once. There was the view that it was “a means of getting rid of people,” with solutions being forced upon them from up the chain. The commander started talking about budgets and VERA/VSIP and ways to do more with less people. We brought this up to him, and he took it to heart. The outside perspective saw a neutral atmosphere with people “testing the waters, waiting to see when to jump in,” looking for initial results.

They view it as another TQM, another thing that we won’t follow up on. They’re leery because they thought it was going to be tied to cutting the workforce, but sitting through an RIE changed a lot of minds. People thought it was one more of those efforts to fix problems, but create more work for them and not make things better. Very high expectation didn’t help. Lean changes are cumulative and accrue over time. Predetermined outcomes were a huge negative and will be resisted by the workforce. Any lean expectation to “cut X%,” is the wrong way to push the program, creating an environment of failure. It needs to be proposed as a way to be effective with reduced resources – how to do a better job with what is at hand. Some feel the lean is something used to get rid of people, while others are “frequent fliers,” who love lean. In the past year workforce impressions have become nonchalant. Without the former commander

it's off their "radar scope." ATEC tying the current lean six-sigma effort to attrition again, means that workforce impressions will "tank."

It starts negative, afterward everybody changes their perspective. They see the good. There were many testimonials in the newsletter from noteworthy participants. They were convinced by "shit-loads of data."

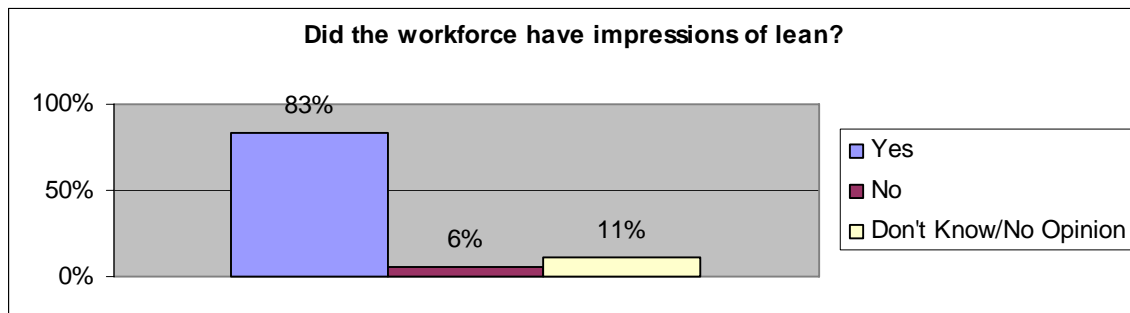


Figure 22 – Survey Question 17

A large majority said that the workforce had impressions of lean. The majority of the written comments indicated a negative impression of lean. Many people thought the workforce saw lean as a waste of time. Many also said it represented a threat to jobs as a way to reduce the workforce. A couple indicated that people are more positive once they see the benefit.

17. Were There Problems/Obstacles/Issues with Lean?

I already covered them in previous answers.

We didn't articulate the real need and importance of lean, first. There were problems carving out time to dedicate to lean. The consultant didn't know our business and couldn't adapt the manufacturing lean to White Sands. I don't think we identified meaningful metrics that are easily tracked. We picked metrics that increased workload, and were not used to make management decisions. We needed to be able to say when to call it done. We could have done better at looking at what higher headquarters was already requiring us measuring, as a guide. The outside view was a real concern about higher headquarters "compounding cuts, based on lean outcomes, which would go against their belief in "reinvestment to balance off the cuts."

Lean works well with manufacturing, the more you get away from that the harder it gets. It took a while to apply lean tools to the White Sands process. The types of waste they were talking about were everywhere. One sign of the need for lean is a lack of measurements. We needed them as a way to measure improvement and see the bottom line, day in and day out, week in and week out – this generates excitement. We didn't stop to install metrics, and then "fell back," without them. This is even more critical with six-sigma, which is a mathematical analysis tool. "If we can't measure for lean, how in the world are we going to measure for six-sigma?" Different people were pushing different things, sometimes pushing into one area and creating a backlash in another. There were problems applying lean to problems that don't fit – it seemed like we were doing lean on things that were obvious. For 30 years White Sands has been downsizing with a lot of savings having already been achieved over that time. The easy fruit is gone; only the hard stuff is left – cultural, philosophical, organizational, entrenched. These can be worked incrementally, as lean is supposed to. If there are no problems then you don't need lean. Lean is not needed if a solution is on the table. It's hard to get good people to join the lean office. If we're not on "the brink of disaster," most federal workers don't think anything can happen to them.

Supervisors would call wanting a lean event that is not a lean event. They just want to leverage lean on something that might be unpalatable, to hide behind.

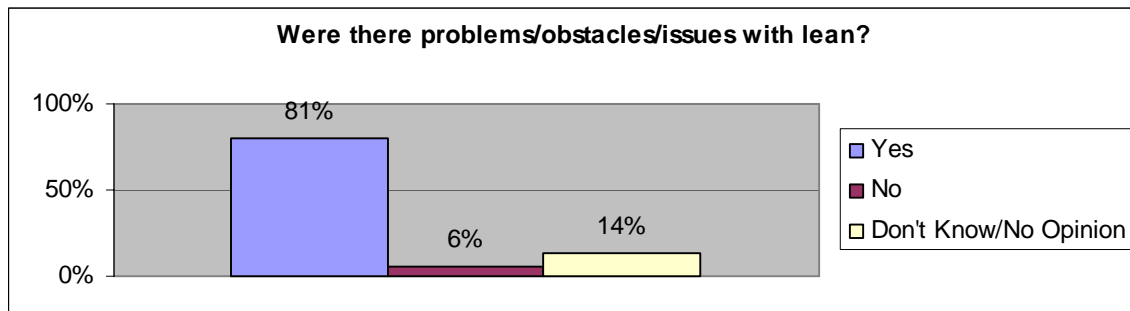


Figure 23 – Survey Question 18

A large majority stated that there were problems with lean at WSMR. Several described lack of management support of lean and following up with the results of lean events. Several spoke to a resistance to change among both the workforce and managers.

Several said that lean was tied to getting rid of jobs. Other comments included the difficulty of getting the right people for lean events and the need for a skilled lean team.

18. Could Anything been done Differently, Based on Those?

We could have secured better training for the whole workforce. We should have looked for bigger returns.

We needed a full time support contractor on site, not one just “popping in.” I’m not sure it should be so, but we have a complicated process. This made events looked good at the beginning but two weeks later we realized that we had 2nd or 3rd order impacts. Maybe we should have focused RIEs on things that would affect our reimbursable ratios. The outside perspective was one of concern with the rapid expected pace of follow-on lean six-sigma activity at White Sands. “They want to do two a week – that’s too fast.”

We should have taken high-level metrics down to a level that would provide each Director with accountability, and communicated that down to the Directorate. We shouldn’t have started anything until this was done. We should have documented processes first, with procedures, and checklists, and captured these before deciding to do an RIE. Many of our processes are done by a single expert with no backup, and nothing written down. RIEs should be geared towards smaller problems and smaller increments, using the tools on a smaller scale. Initial screening of projects would have cleared things up and targeted the most important areas.

This goes back to educating the workforce, and getting past negative thoughts from an event that went bad.

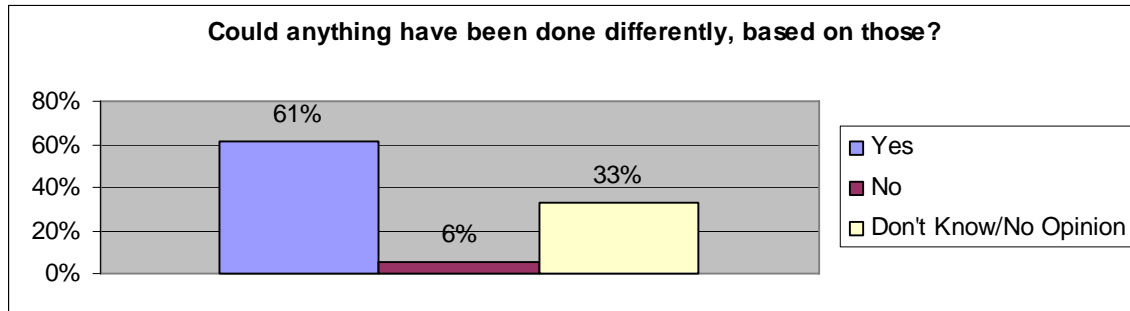


Figure 24 – Survey Question 19

Most participants said that things could have been differently based on the problems identified in question 18. Suggestions include: better training, implementing recommendations, increased staffing for lean team, never link lean to personnel cuts, show workforce lean improvements, increasing the lean team's training, and documenting processes before a lean event.

19. Were There Benefits from Lean?

I already covered them in previous answers.

There was no real tangible reduction in resource requirements, or they were not tracked well. People did stop to take a look at, and document, their processes. We did quite doing some things that made no sense, and made folks aware that we are in a sparse resource environment with a need for more efficiency. Culture and attitude changed a little - "there's a better way of doing things." RIE team members got a better understanding of areas outside their own. The outside view was, "don't know of any right off the top of my head, but the reorganization has really improved things, and VERA/VSIP was a huge savings. The reorganization was a good example of lean thinking. There was no rice-bowl fighting, they held nothing back. "I've never seen anything like it."

I think the concepts are sound and apply. The benefits could have been staggering, but the actual benefit was small. Not a single documented process was followed at White Sands. Not a single branch was keeping metrics. We did see some improvement and did get some good training. We needed to get repeatable processes in

place first; otherwise we wouldn't know how to quantify. All the literature said there was a cost, but the ROI would be greater. We did eliminate some things or "do them better." The cost was \$810K to save a few dollars here and there. On Performance the new investment process was a success. They were there and talking, at least, which could increase the quality of IDAPS. The customer proposal process was a success, and lean tools and terms are catching on. On Scheduling, I just don't see it. The scheduling RIE spawned 9 projects and there's no word on where they are.

It was mostly low hanging fruit. We have some metrics, or should have. A lot were documented processes. The solution was a documented process in lean, not in lean six-sigma, though.

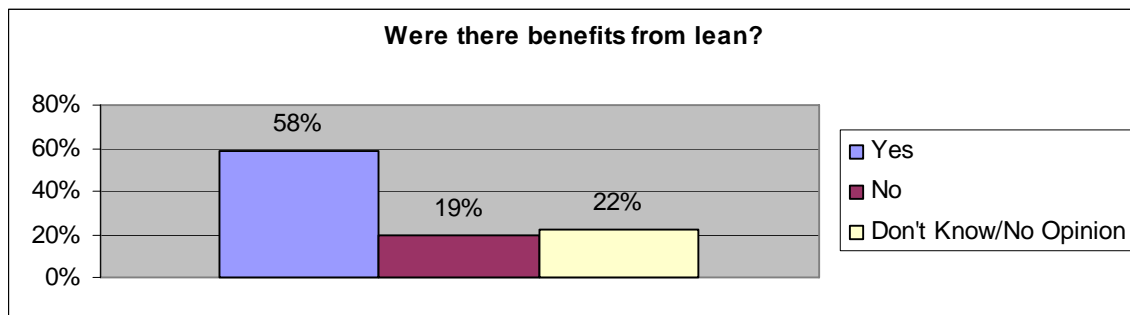


Figure 25 – Survey Question 20

Most participants said there were benefits to lean. Stated benefits include: improved processes (less time), unnecessary processes were streamlined or eliminated, money savings, increased communication and cooperation, processes were documented, and people were awakened to potential waste.

A culture change was described. "The biggest benefit was the change of direction for WSMR. We have gone from following the GM business model ("we'll always be in control of our industry cause we are the biggest guy on the block") to following the Toyota business model ("what can we do to improve our products and satisfy our customer"). I think as more LEAN thinking managers ascend to top of WSMR chain of command, the speed of change will accelerate down this directional path."

One last related comment was interesting. "Again process reviews are always good; we relearned that they should happen frequently. Also good coffee is important.

The horrible coffee at the PDC doesn't help. With great coffee people become less hostile and willing to see the other point of view."

When asked how the benefits were measured most described metrics associated with a given event such as: reimbursable versus institutional hours, time savings, time to deliver a product, and cost savings.

20. Was There a Cost Associated with Lean?

It is the "cost of doing business" a necessary cost, a drop in the bucket. An investment with 10 or 20 fold returns is not unheard of. The actual cost could be \$1M to \$2M.

\$1M to set up lean, in a tough budget year. The contract consultant cost for a couple of years was hundreds of thousands. The labor cost was eight man-years plus the labor cost of the RIEs. This should be easily outstripped by efficiencies, in theory. It was a great value, especially the early VSAs, like customer proposals. There was good customer feedback on that, but there's still room for improvement. Ideally we wanted to track the real cost. I suspect that cost was more than what we said. The cost tracking was "hit or miss." I think it was worth it – "you've got to do this if you're going to survive." The outside view was that there is always cost associated with change, usually up front. "I don't know what it is, but I think that it is worth it."

Absolutely. The lean consultant cost was \$260K/year. Ten people in the lean office are about \$1M. Seven people in an RIE, 4 times a month is equal to about 12,000 hours. That's about \$600K, for a total of \$1.8M. A sign of success is to "pay as you go." So if we don't see savings of \$1.8M then we are not successful. "The people we freed up should have been put on the lean team." We started out with 10 and ended up with 8 on the team, backwards from what it should have been. We did fewer rather than more lean events as time went along. We were not as successful as originally envisioned. The cost was in time! A lot of people were tied up in training and documenting processes. There was some conflict with mission activity, affecting the availability of people. We never

“lost a mission, though – “we kept our priorities.” Anticipated cost of new ATEC effort would be \$2M, to cover the cost of 10 black belts and 30 green belts.

\$1M for the lean consultant plus labor for ten or eleven of us in the lean office, where the lowest was grade was GS-11. It was all overhead so you better show a return.

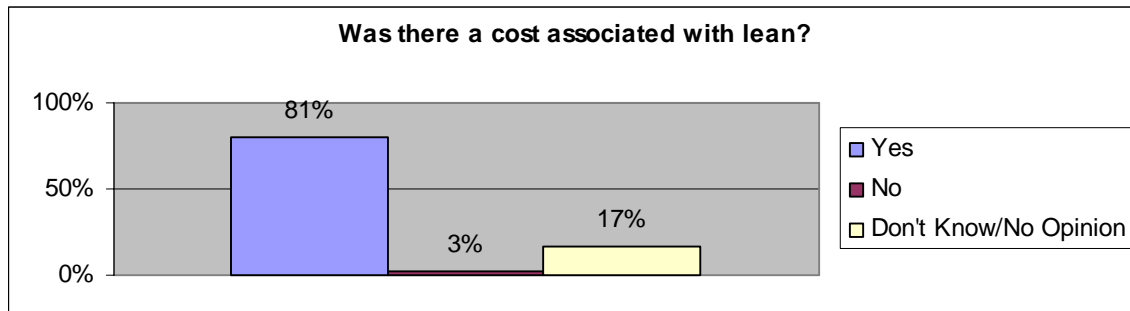


Figure 26 – Survey Question 21

Most people thought there was a cost associated with lean. The overwhelming cost identified was the time and labor associated with participants of lean events. There was a wide range of estimates associated with the actual dollars spent in support of lean.

21. Do You Have a Personal Opinion of Lean?

It has promise, as a tool, and we should be using it. I fully support it. It needs to be supplemented with theory of constraints and systems engineering.

It will definitely help us transform the Range. “It’s the best thing we’ve got going.” If it ain’t broke don’t fix it, doesn’t hold anymore in the current Army strategic position. “If it ain’t broke, how can we make it better?” It is a great tool among lots of tools. I wholeheartedly support giving people the time to look at their processes, to stop and find a better way. I hope it can be flexible, and not be locked into the tools. I am “guardedly optimistic” about lean six-sigma “being pushed down in all it’s glory, with the number of black belts and the number of green belts.” We’re better off than most of the Army because we have done lean already. It’s very necessary. The outside view was one of belief in lean, with the caveat that it is, “harder in an office environment, but well worth it.”

I totally buy in to the principles. Inefficiency in the Government is greater than in industry. There's more bureaucracy and no bottom line. In the Government we are more worried about the mission, with no profit motive. Opportunities for lean at White Sands were staggering, but there was a big cost to implement – so you better “be serious.” Before it was TQM with elements of metrics, performance, and measuring quality. Lean is similar but centered on waste. It is a tool, but it's “only as good as the one using it. I can use a chisel to break stone down to gravel, or sculpt a statue.” I like the program. I understand lean for small projects, and lean six-sigma for large projects. I still think we need to be up front with personnel cuts tied to lean. Would have been better off to do A-76 studies in places where we wanted to make specific cuts.

Lean is too basic; it focuses on waste with no statistical tools. I like it and believe in it at a lower level. Lean six-sigma looks a lot more powerful.

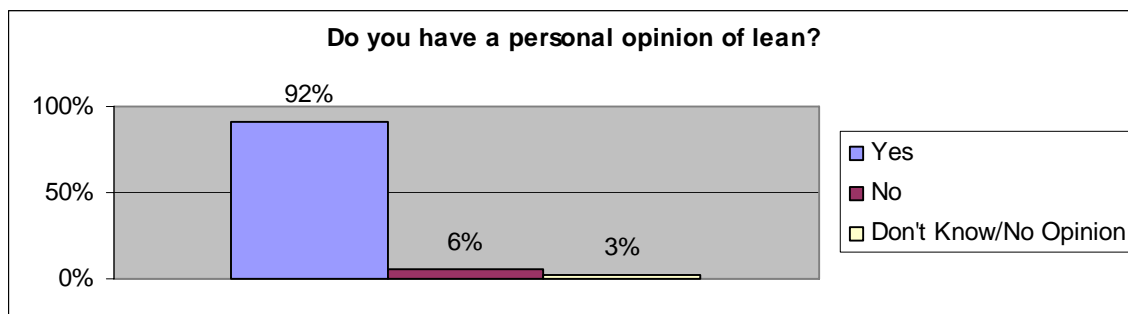


Figure 27 – Survey Question 22

The vast majority of participants have an opinion. There were a couple that indicated a negative opinion of lean but the majority of the comments indicated a positive opinion of lean and its potential if done correctly.

“In theory, it's a good program and could change and improve things considerably. But with civil servants, there's the problem of entrenchment, fear of change, unwillingness to try new ideas. Even an unwillingness to save money.”

“I believe the result is worth the effort. I believe that getting the right personnel with the expertise is important. I think that it is worth pursuing in the future.”

“I think for some work processes it can help, but like I mentioned before I never saw the recommendations that came out of the RIE implemented. I also think

management calls for a lean event knowing already what recommendations they want to come out of it. Why do that, just make your management decision.”

22. Should Lean Continue to be Used at White Sands?

Absolutely, but I wish we didn’t have the ATEC \$250K savings, or Army 30% efficiency increase, expected up front.

We definitely need to continue – not driven down, but fostered and supported at all levels. “Call it what you will, we need to continue.” I think we need an offsite where we can ask, “what are the lessons learned,” “how can we do lean and support the Army’s lean six-sigma?” Maybe we can have some impact on what will happen. The outside view was that we should continue, even if it had not been mandated. “Just follow the lean office, and take time to make the culture change.”

Only if it will pay for itself. If we’re not getting a return, then we shouldn’t do it. It should be a positive return, not just a break even. The commander was the consummate advocate and spokesman, and he wasn’t able to turn things around. Who could do better than that? I don’t know. The commander needed a Directorate to buy in completely and get a thread all the way down to the working level. We really didn’t see that. We have lost money in it, so far and should be looking for a return on investment to continue. The customer is looking for a bottom line also, or else they don’t care. Yes, we need to document processes, initiate culture change, and take small steps. We should do what ATEC wants up front for lean six-sigma, and continue with lean “on the edges.” In the meantime this is a good exercise.

Definitely. We’re looking now at lean six-sigma and bigger projects. With lean, the first time, there were no belts, so we got screwed. I’m looking at property accountability in 2005, about \$750K in possible savings. Lean would have just looked at hand receipts. Lean six-sigma looks at the whole thing.

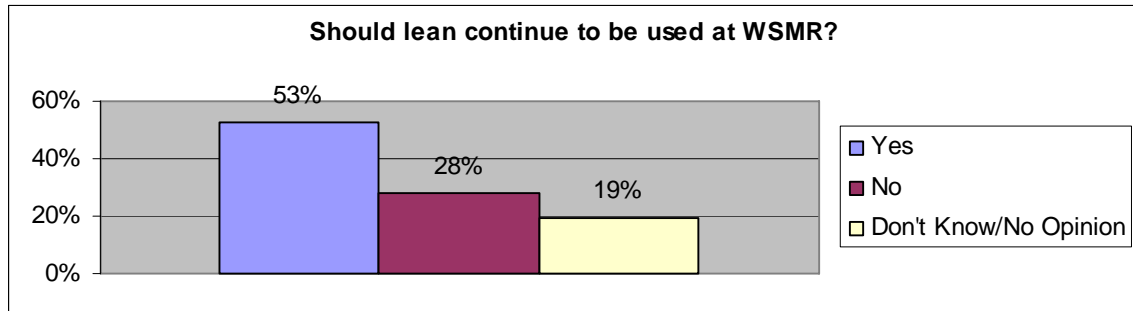


Figure 28 – Survey Question 23

The majority of the participants thought that lean should continue at WSMR. Recommendations include: educating the workforce, management buy-in, resource appropriately, common goals, and document process up front.

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